JUNE · 1957

ELECTRICAL CONSTRUCTION AND MAINTENANCE

WITH ELECTRICAL CONTRACTING



NISA elects Alfred Elson, Jr. of New England Machine & Electric Co., Pawtucket, R. I., president.

page 219

Third Tube of New York -New Jersey Lincoln Tunnel has \$8 million electrical installation.

page 85



56 TH YEAR



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ACCURATE TAPE

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ACCURATE MANUFACTURING CO

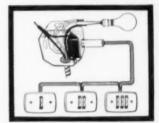
I switched to REMCON

"My men do wiring jobs in half the time — now that I've switched to REMCON. Why? Part of the reason is because REMCON's 6-volt system eliminated the need for a switch box. All you have to do is nail up a plaster ring and you're ready to hook on your switches. It's easier for my men, and the time they save means 40% more profit for me. Even the Master Control which my builder-customers insist on, is simple to install. You bet I've switched to REMCON."

Carl G. Tiersch Elmont Electric Co. Massapequa, L. I., N. Y.

HOW REMCON CUTS TIME-

- Replaces armored cable on all switch legs with easy-to-handle and strip No. 18 wire.
- Most economical way of installing 3-way switches. Just match the 3 terminals of each switch to the 3 wires of each relay.
- Each relay is self-energized. So, it's simple to add as many switches as you wish to each relay.
- Simple to control many lights from one point, or control one light from many points.
- Silent...no click at the switch, no hum at the relay.



The switch with the Hi-Fashion "Look of Tomorrow"

REMCON

Simplified Low Voltage Switching

There's a REMCON product for every switching need.

Write PYRAMID INSTRUMENT CORPORATION, Lynbrook, N. Y. (Makers of the world-famous AMPROBE snap-around volt-amp tester.)



Now Westinghouse offers a completely new manual auto-starter with air break contacts in all sizes... for starting motors from 5 to 250 hp. Gone forever are the costly "oil problems" of oil level checks, spilling, messy oil changes and contamination. Tests prove that air break operation gives additional benefits in much longer contact life. Westinghouse gives you all this plus premium-quality silver-alloy contact surfaces and the De-ion® arc quenching chamber for guaranteed long trouble-free service.

There is a host of additional moneysaving features incorporated in the new Westinghouse "JF" auto-starter to make it your best buy today. For all the facts call your Westinghouse sales representative or nearby Westinghouse distributor, or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania.

YOU CAN BE SURE ... IF IT'S Westinghouse



ELECTRICAL CONSTRUCTION AND MAINTENANCE

Published for electrical contractors, industrial electricians, engineers, consultants, inspectors and motor shops. Covering engineering, installation, repair, maintenance and management, in the field of electrical construction and maintenance.

with which is consolidated Electrical Contracting. The Electropist and Electrical Record . Established 1901

56th Year JUNE • 1957

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Vol. 56, No. 6

ELECTRICAL CONSTRUCTION and MAINTENANCE

Published monthly with an additional issue in September by McGraw-Hill Publishing Company, Inc. James H. McGraw (1800-1989). Founder, Executive, Editorial and Advertising Offices, McGraw-Hill Building, 339 W. 4.2nd St., New York 38, N. Y. Publication Office, 99-12 Monthly Company, Albany 1. N. Y. Donald C. McGraw, President L. McGladrich, Vice-President and Treasurer; John J. Cooke, Secretary; Nelson Bond, Executive Vice-President and Editorial Director; Joseph H. Allen, Vice-President and Editorial Director; Joseph H. Allen, Vice-President and Circulation Coordinator.

Subscriptions are solicited only from persons engaged in electrical construction, maintenance or consulting services. Position and company connection must be indicated on subscription erders. United States subscription rate for individuals in the field of the publication \$3.50 per year. This issue 40 cents. Electrical Products Guide 22.50. Canada, 35.00 a year. All other countries, \$15.00 a year, payable in Canada, 35.00 a year, All other countries, \$15.00 a year, payable in Canada, 35.70 a year, under act of Mar. 3, 1873. Printed in U. S. A. G. Capyriphical 1957 by McGraw-Hill Publishing Co. Inc.—All Rights Reserved.

SUBSCRIPTIONS: Send subscription correspondence and change of address to Subscription Manager, Electrical Construction and Maintenance, 330 West 42nd Street, New York 36, N. Y. Subscribers should notify Subscription Manager promptly of any change of address, giving old as well as new address, and including postal zone number, if any. If possible, enclose an address label from a recent issue of the magazine. Please allow one month for change to become effective.

Sidelights

CD WARNING SYSTEM-One of the recommendations of the Federal Civil Defense Administration is that a distinctive CD Warning System be provided in large industrial plants, department stores, office buildings, or similar buildings housing a large number of people. In most cases, this involves a number of problems-type of signal, method of supplying power, automatic operation, cost, etc. These problems were met and solved successfully for the 6000 employees in the Government Printing Office, Washington, D. C., under the guidance of GPO's electrical engineer Daniel W. Willingmyre. For details, see his article on "GPO Installs Automatic CD Warning System," beginning on page 102.

LINCOLN TUNNEL—A couple of weeks ago traffic began flowing through the new third tube of the Lincoln Tunnel joining New Jersey and mid-Manhattan. The mile-and-a-half-long tube under the Hudson with its approaches at either end involved an Semillion electrical job handled by four electrical contractors, Fischbach and Moore, Lightning Electric Service, Jandous Electrical Construction

and Plymouth Electrical Construction.

Six primary sources serve the lighting power and control installation. The electrical features are described by James F. Meyers of the Port of N. Y. Authority beginning on page 85.

A second article, describing the job methods developed by the contractors to meet the special problems encountered, will appear in the July issue.

BULK COOLING-A change in milkhandling practice in the North Central area is opening up a substantial wiring market for electrical contractors-often including a major service replacement. The familiar milk cans on roadside loading platform are giving way to bulk storage and cooling with tank-truck pickup. Power service is needed for the cooler and for the tank-truck transfer pump. Power use advisors recommend a 200-amp main service with a 100-amp supply to the barn and milk house. Middle West Editor August Eckel describes the electrical installation requirements in "Bulk Milk Coolers Boost Farm Electric Service Needs" on page 106.

ELECTRIC COOKING—In the new Socony Mobil building in New York,

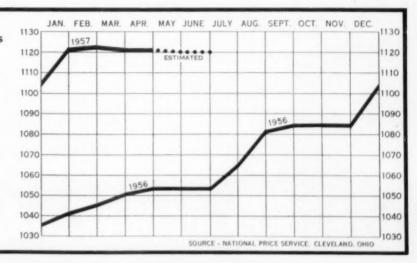
seven dining rooms, a lounge and a cafeteria are served from an all-electric kitchen. A special feature of the electric installation is the 800 kva power supply stepped down from the 460-volt distribution system through low-decibel rated dry type transformers. See "800 KVA for All-Electric Dining" on page 98.

LIGHTING MONUMENTS— Through the ages man has built monuments dedicated to people, battles,

ments dedicated to people, battles, ideas, events. In earlier times these monuments were sometimes lighted at night, for festive occasions, by torches, Then, with the coming of electricity, floodlights were developed, about half a century ago, which made possible the lighting of these monuments every night at the flick of a switch. While many monuments have been floodlighted during the past 50 years, there are thousands which are visible only by day, and which are now prospects for floodlighting so that they may be seen in a new beauty by night. For helpful information on planning successful floodlighting for these monuments, see "Design Considerations for Monument Floodlighting," which begins on page 95.

ELECTRICAL MATERIALS COST INDEX

BASE LINE IS 1000 AND REPRESENTS COSTS OF A TYPICAL ASSORTMENT OF MATERIALS FOR A SELECTED JOB AS OF NOVEMBER 1, 1951. THE INDEX POINTS REPRESENT THE VARIATION OF THESE SAME MATERIAL COSTS AS OF THE FIRST OF EACH MONTH.



CROUSE-HINDS Condulet* motor controls Occupy Less Space!





Explosion-Proof Combination Motor Starters and Circuit Breakers . . . in a 25 ft. x 6 ft. Area!

Crouse-Hinds Condulet* Type EPC Motor Starters and Circuit Breakers are explosion-proof, dust-tight (dustignition-proof) and weather-resistant (raintight).

Lightweight cast aluminum construction for easy installation without use of lifting equipment.

Seven Conduit entrances simplify installation.

Built-in push button stations and selector switches are available.

Starter sizes 0 to 5. Circuit breakers 50 to 600-amp, frame sizes.

In the installation shown above, 48 Crouse-Hinds Condulet* Type EPC combination motor starters and circuit breakers are compactly arranged in four racks.

If necessary, the 25 ft. x 6 ft. area used could have been cut in half by installing the Condulet motor controls in two tiers. Or, twice as many Condulet controls could have been installed in the same area, if required.

The vertical design of Crouse-Hinds motor starters, circuit breakers and combinations allows them to be installed only ¼" apart. This compactness produces savings in the construction of steel mounting racks, and in the use of premium floor space.

For help in solving a space problem, see your Crouse-Hinds distributor . . . or call the nearest Office listed below

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Washington Report

A spotty economy for the balance of 1957, with an upturn next year, was predicted early last month by Secretary of Commerce Sinclair Week's Business Advisory Council, meeting at Hot Springs, Va. Composed of some of the nation's top industrial and financial leaders and Government officials BAC members agreed that autos, housing, and other key segments of the economy are this year falling short of expectations. They also endorsed generally FRB's tight credit policy, and pinpointed price inflation as the chief threat to economic stability.

New construction expenditures totaled \$3.5 billion in April, compared with \$3.4 billion in April 1956. But the dollar volume increase was attributed to higher prices, Commerce and Labor Depts. said, who reported that physical volume probably declined. Construction outlays were reported at \$12.5 billion for the first four months of this year, or 2% higher than a year earlier. Publicly-financed work, up 11% from a year ago, accounted for the entire gain, the Agency reported. Private spending declined 1% during this period.

April housing starts increased to 92,000 from the March total of 83,000, but were at the lowest level for the month since 1949, Labor Dept. reported. This was 17% below April of last year, and accounts primarily for the decline in private construction spending this year from last year's record. Store building during this year's first four months also dropped 17% below the similar period of last year.

Congress is reportedly ready to boost housing, through legislation designed to draw more money into the mortgage market and to cut down requirements on payments. But direct Federal spending or lending seems unlikely, especially in view of the economy move now under way to trim

the Federal budget for the 1958 fiscal year beginning July 1.

The 13-year 41,000-mile Federal aid highway program signed into law last June, has progressed very slowly during its first year, but will begin to pick up speed in the coming year, according to the Federal engineers and administrators. During the first eleven months final construction contracts have been let on 1,043 miles of new interstate highways. But the public will see very little results for months to come. By 1961, it is estimated that about 3000 miles of highways will be built annually; but manpower shortages, lack of state funds to match Federal aid in some states, materials shortages, and rising costs are expected to extend the program some three or four years.

Economic highlights—Steel production in April dropped to 9,814,000 tons from March total of 10,589,000 tons, and weekly production in May dropped to new low for 1957 of 84.2% of capacity . . . Electric power output declined to an 8-month low in weekly rate early in May, or 11.286 billion kwhr . . . Employment in April was 64.5 million compared with 63.8 million a year earlier. Labor Secretary Mitchell predicts a rise in employment to 68 million this summer, compared with the previous record of 66.5 million last August . . . Gross national product for first quarter was at record \$427.1 billion seasonally adjusted annual rate, for which roughly two-thirds of the increase stemmed from price increases, Govern-Personal income rose to a new high of \$339.3 billion seasonally adjusted annual rate in April, due to higher wages and increased old-age benefits, Commerce Dept. reported . . . Industrial production was at 148 (FRB Index) in March, up five points in a year sumer credit was \$40.5 billion at end of March, or \$2.7 billion more than



ADVANCE Stocking Distributor Plan

Makes Fluorescent Lamp Ballast Servicing Simple . .

The ADVANCE Fluorescent Lamp Ballast Servicing Plan saves time and money for electrical contractors, lighting equipment manufacturers, engineers, electric utilities, architects and users of fluorescent lighting equipment. To serve you in this program ADVANCE, the world's largest exclusive ballast manufacturer, has appointed a nationwide network of service-stocking distributors. These authorized distributors carry a complete stock of ADVANCE ballasts and will replace, WITHOUT CHARGE, any ADVANCE ballast which becomes inoperative within the two-year warranty period. From this ADVANCE stock, which includes ballasts to operate all fluorescent lamps, you can also get immediate replacement service for any other make ballast.

ADVANCE QUALITY Fluorescent Lamp Ballasts are packaged in modern individual cartons that put an end to loose dangling lead wires, prevent damage to lead wire and assure you of factory fresh ballast stock always. End labels on the new individual cartons permit instant identification of ballast type, catalog number and pertinent electrical characteristics.

The ADVANCE label is assurance of dependable, efficient performance at lowest cost . . . the result of years of engineering and development that have made ADVANCE fluorescent lamp ballasts "The Heart of The Lighting Industry".

The new ADVANCE Buyer's Guide, the Cross-reference Fluorescent Lamp **Ballast Replacement** Chart together with the newest brechure listing authorized ADVANCE Service-Stocking Distributors will be sent to you without cost or obligation. Write today!





The Heart of the Lighting Industry



What Research Means to American Business

American industry plans to invest \$150 billion in new plant and equipment during the next four years—more than in the five years 1952-1956. It plans to carry out this record investment even though manufacturing capacity has nearly doubled since World War II. These facts are reported in McGraw-Hill's tenth annual survey of Business' Plans for New Plants and Equipment. They contradict many long-established theories about investment in capital goods.

According to the textbooks, a high and rising level of capital investment is generally followed by a decline. The bigger the rise—so the old theory goes—the bigger the decline will be. But, after a decade of high-level investment and an especially strong rise in the past two years, industry now has plans to keep right on with near-record outlays for plant and equipment. Does this mean some new factor has been added, to change the investment cycle?

The New Factor - Research

The latest McGraw-Hill survey points out one new factor which, more than any other, is changing the nature of the investment process. This is the record outlay planned by U.S. corporations for scientific research and development—to create new products and develop new industrial processes. The rapid growth of research in industry, and plans for even more remarkable growth in the years ahead, are shown by the accompanying table.

This year industry plans to spend \$7 billion on research and development — up 20% from 1956. By 1960 it will spend \$9 billion — enough to create a major new industry.

By 1960 manufacturing industry expects sales to be up 26%—with half the increase in products that were not made in 1956.

Growth of Research and Development Expenditures

(Millions of Dollars)

		PLANNED		
1955	1956	1957	1960	
Machinery 408	506	577	704	
Electrical Equipment 950	1,149	1.310	1,637	
Aircraft and Parts	1,558	2,274	3,161	
Fabricated Metal Products				
and Ordnance 134	165	174	210	
Professional and Scientific				
Instruments 185	252	300	453	
Chemicals 440	498	528	617	
Paper, Rubber, Stone, Clay				
and Glass Products 149	174	196	233	
Petroleum Products	205	225	277	
Other Manufacturing	1,279	1,388	1.557	
Non-manufacturing industries 254	310	347	419	
ALL INDUSTRIES4.767	6.096	7,319	9,269	

What Research Is Doing

Here are some examples of how industrial research is opening up new markets, or compelling the modernization of old facilities:

New automatic controls in petroleum refining will raise the quality of gasoline and reduce the time required for production. A new process for recovering oil from depleted wells promises to multiply our potential reserves.

A new process for treating iron ore will permit the ore to be fed directly into steel furnaces—without the need for blast furnaces or coke ovens.

New turbine engines — made possible by the development of heat-resistant alloys for turbine parts — offer greatly increased power for aircraft, ships and automobiles.

Altogether, industry plans to introduce more new products in 1957-1960 than in any previous four-year period. It also plans new processes on a scale that will make much of our present capacity obsolete. These new products and new processes are the secret behind continuing plans for high investment.

One-third of all manufacturing firms are building new plants this year to produce new products, and by 1960 this may account for 10% to 20% of all capital expenditures. At the same time, manufacturing companies report that over half their capital expenditures in the next four years will be for modernization of equipment and introduction of new processes. Thus the preponderant share of new investment will be based on developments growing out of research.

A New Kind of Prosperity

The keen interest of U.S. business firms in scientific research points the way to a new kind of prosperity for our economy —a prosperity based on deliberate creativeness. As long as we can create new products that will offer better value to consumers or cut costs to manufacturing firms, business will continue at a high level—not at fever pitch, perhaps, and it is to be hoped not at an inflationary pitch. But based on a steady stream of new products and processes, we can have a high level of general prosperity that defies the old laws of boom and bust.

It's Not Automatic

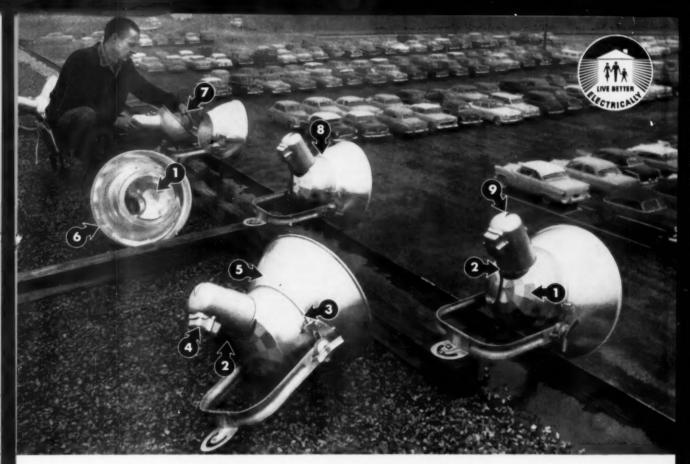
Of course, there is no guarantee. New products do not spring up by magic as the medieval alchemists hoped they would. They are found as the result of long and expensive effort in laboratories and pilot plants. This effort requires an increasing number of trained scientists and engineers. In 1957 alone, manufacturing companies report they will need 7% more of these highly trained people in research and development. And by 1960, they will need an additional 15% to carry out planned research programs.

The effort to maintain prosperity — as well as the national defense effort — will depend increasingly on this supply of scientific and technical personnel. But if we can supply the people, industry now has the plans for a research effort that will put an end to the spectre of idle plants and idle workers.

This message is one of a series prepared by the McGraw-Hill Department of Economics to help increase public knowledge and understanding of important nation-wide developments. Permission is freely extended to newspapers, groups or individuals to quote or reprint all or parts of the text.

Donald C McGraw-

McGRAW-HILL PUBLISHING COMPANY, INC.



9 REASONS WHY THE NEW "DIAMOND-BACK" . . .

General Electric L-69A delivers more light, goes in faster, services easier, costs less!

Here are nine quality features which make the General Electric L-69A your best 1500-watt general-purpose floodlight buy:

1 DIAMOND-SHAPED REAR REFLECTOR. An exclusive in the L-69A, the faceted back reflects light like a finely cut diamond. Result: 5% to 35% more light—and more uniformly distributed light—on the area you are illuminating.

2 CHOICE OF WIRED OR UNWIRED. You can get the L-69A pre-wired with four-foot cable—or buy it unwired, cut your original cost, and eliminate five to ten minutes splicing each unit.

3 WATER-SHEDDING ASSEMBLY. New design makes large, perishable gaskets unnecessary. No other floodlight in its class has as little gasketing as the L-69A!

4 EXTERNAL WIRING BOX. Wiring is faster, simpler with this easy-to-get-at terminal box. Cable insulation life is increased many times since terminals are located away from lamp's heat.

5 LIGHTEST IN ITS CLASS. The L-69A weighs an easy-to-handle 17 pounds when it comes to you (fully assembled).

6 CHOICE OF DOOR GLASSES. Only with the L-69A do you get a choice of watertight, spun-sealed door glass or removable, clamp-on door glass. Both are impact-resisting.

7 EASY TO RELAMP. Just unsnap two toggle latches and, without bothering front reflector, lift off light (4-lb.) faceted rear reflector and lamp housing. Removable portion can be clipped to trunnion bracket during relamping or cleaning. 8 IT'S COOL! Lamps, insulation, and wiring last longer in the L-69A, coolest-operating 1500-watt flood on the market. New socket shell and housing designs reduce "baking" caused by lamp heat.

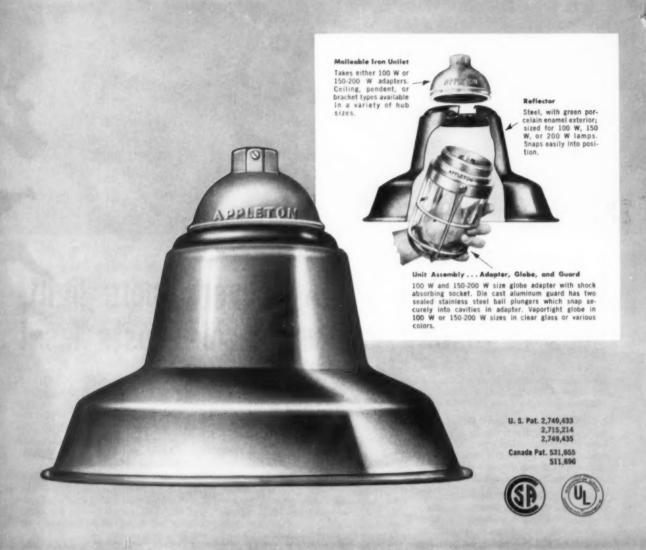
9 V-NOTCH AIMING. Easy external sighting speeds installation, simplifies adjustment for best lighting results.

Available in four beam widths—very narrow, narrow, medium, wide—the L-69A is ideal for lighting sports and recreational areas, railroad yards, industrial loading and storage areas, parking lots, shopping centers, etc.

Ask for the L-69A—the floodlight with the diamond back—when you contact your authorized G-E floodlighting distributor! General Electric Co., Section 451-196, Schenectady, New York.

GENERAL (ELECTRIC

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V-51 Series Convertible Vaportight Fixtures

Require only seconds

to relamp or convert!

One trip up the ladder, a few quick twists of the wrist, and relamping or wattage conversion is done! V-51 reflectors with integral neoprene ring adapt perfectly to the grooved unilet... permit instantaneous substitution of reflectors. For economical service and maintenance, it's hard to find anything more practical than Appleton's V-51 Series exclusive unit assembly (adapter, receptacle, globe, and guard). Shock absorbing socket cuts lamp replacement costs. Try the Appleton V-51 Series standard or shallow dome, deep bowl, or angle type reflectors and 100 W and 150/200 W vaportight unit assemblies in your plant today. Available in a variety of hub sizes in pendent, ceiling, or bracket type fixtures for every kind of installation.



Maintenance man takes spare assembly to lamp requiring replacement or wattage change . . . removes lamp assembly . . . screws fresh unit in place and the job is done! Higher wattages of 150/200 are interchangeable with 100 watt unit and can be used in same unitet body. (Die-cast aluminum guard turns counter clockwise to act as a tool for easy removal in relamoine).

An upward thrust and slight quarter twist engages neoprene ring with the groove in the unilet and snaps the reflector in position. Entire operation of removing lamp, inserting new unitet, and positioning of reflector requires no special tools... no set screws... no small parts to juggle. Absolute simplicity!



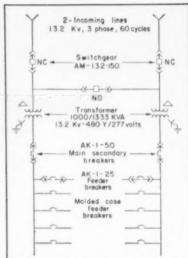
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Rely on APPLETON...the Standard for Better Wiring®





AS MODERN AS TOMORROW, the Sheraton Hotel combines this highly efficient 480Y/277-volt electrical distribution system with forward-looking construction.



INCOMING SERVICE AT 13.2 KV is reliably handled by easy-to-maintain G-E metal-clad vertical lift switchgear.



SAFER G-E panelboards with molded-case circuit breakers are designed to occupy little space, permit easy wiring. They are installed in wiring closets.

General Electric 480Y/277-Volt Distribution System Permits \$50,000 Savings at New Sheraton Hotel

MODERN HOTEL COMBINES FLEXIBLE LOAD CENTER SYSTEM, HIGH **VOLTAGE LIGHTING TO CUT EQUIPMENT, INSTALLATION COSTS**

Rising 22 floors above Philadelphia's comfort and services for hotel guests. Penn Center, the ultra modern Sheraton Hotel combines the latest in construction details with an efficient high voltage electrical power distribution system which is currently buildings.

the new Philadelphia Sheraton Hotel has incorporated a General Electric 480Y/277-volt electrical system which permitted savings of \$50,000. To design this modern system, G-E being installed in many commercial engineers worked closely with consultants Slocum and Fuller; and Designed to provide maximum architects Perry, Shaw, Hepburn, and

Dean. The electrical contractor was Keystone Engineering Corporation. One feature of the system is the installation of G.E.'s new quiet, drytype, general purpose transformers. These low-noise-level transformers add further comfort for Sheraton Hotel guests.

From primary switchgear at the incoming line through secondary distribution and protective apparatus, General Electric system-engineered equipment provides highly reliable power at the Sheraton.

To see how General Electric can help you achieve significant savings with a 480Y/277-volt electrical distribution system, consult your nearest G-E Apparatus Sales Office or write to General Electric Company, Section 680-11, Schenectady, N. Y.



FLEXIBLE double-ended load center unit substation with integrated units furnishes highly dependable power close to load.



COMPACT low voltage switchgear and distribution switchboard protect low voltage side of "packaged power" system.

Engineered Electrical Systems for Commercial Buildings

GENERAL & ELECTRIC



QUIET General Electric dry-type transformers, with low-noise-level characteristics, help improve sleeping comfort for Sheraton guests.

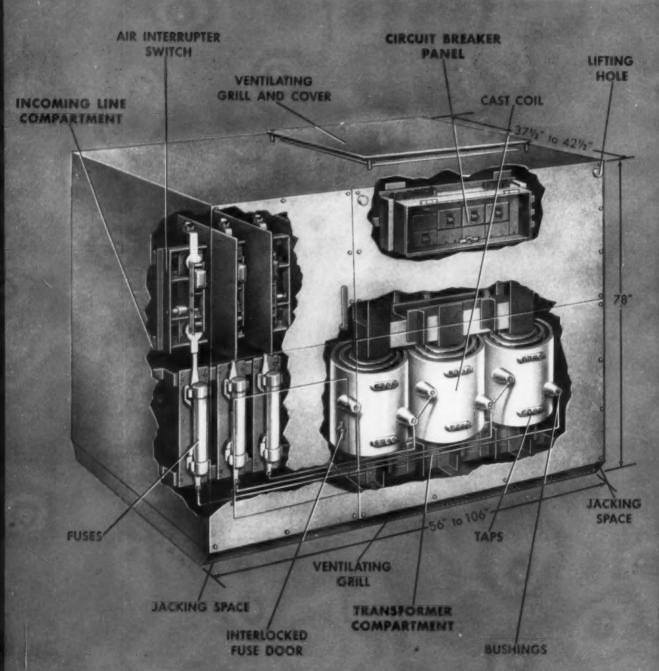


DECORATIVE LIGHTING enhances main ballroom. High voltage lighting in many areas of hotel permits low-cost use of combined light and power system.



COORDINATING THE PROJECT were M. Savitt of Slocum and Fuller, H. Cohen and L. Evelev of Keystone, T. S. Duff of Slocum and Fuller and A. M. Cook, G.E.

New General Electric cuts installation time,



Typical arrangement of a 15 kv dry-type Integral Distribution Center with fused air interrupter switch

integral distribution center simplifies ordering

Now, General Electric offers an advanced concept in load center design with its new dry-type integral distribution center. This new one-piece G-E distribution center combines the three separate components (incoming line, transformer, outgoing feeder) normally found in conventional systems into the one truly integral unit. Installation time is substantially reduced and ordering greatly simplified.

SMALL enough to pass through any normal size factory door, the new G-E integral distribution center is only 78 inches high (80 inches installed), 37½ to 42½ inches deep, and from 56 to 106 inches wide depending on the accessory equipment required. Unit takes up less space, is easier to handle.

ONE-PIECE DESIGN makes installation easier—eliminates need for assembling and testing separate components at point

of installation. Jacking space is built in on two sides of the distribution centerno projecting jacking bosses to get in your way. Once unit is in place, it can be rolled or skidded in any direction for easy positioning. Further, all units are furnished with solderless connectors for incoming and outgoing lines. Both lines can be brought in through either the top or bottom of the unit. Just connect the lines and the unit is ready for operation. Switches, fuses, circuit breakers and taps are front accessible no aisle space needed on sides of unit. Center is completely metal-clad, inherently fire and explosion resistant can be placed as close to the wall as local codes will allow.

A COMPLETE LINE is available in standard ratings from 75 to 225 kva for industrial plants, warehouses, office buildings, schools, light-load areas in utility systems and similar applications.

Standard voltage ratings run from 208 to 15,000 volts. Units over 5 kv are equipped with encapsulated coils for better resistance to abnormal voltage surges and better protection against dust and moisture for longer life. Bushings and taps are integral parts of each unit meaning less chance of bushing breakage.

QUIET OPERATION is another important feature of the G-E integral distribution center. All one-piece units are rated at 56 decibels—10 decibels under NEMA specification.

AS STANDARD EQUIPMENT on the incoming line section, you have a choice of oil filled cutouts with fuses, air interrupter switches with or without fuses, or terminal connectors. If fuses are used with the air interrupter switch, a mechanical interlock is installed on the fuse door for greater operated safety.

AS EASY TO ORDER AS AN ORDINARY DRY-TYPE TRANSFORMER

Now you can order a General Electric integral distribution center in the same manner in which you would order an ordinary dry-type transformer—by use, not by the way it's put together. No need to figure out the size of the switch, fuses or other incoming accessories you might choose. All these things and more are done for you automatically, thus reducing the possibility of inadvertent errors in ordering. Of course, all component equipment meets NEMA and ASA specifications.

To order a G-E one-piece distribution center, just answer these three questions: what is the available primary voltage; what is the desired secondary voltage; and what is the required kva? Then select one of the four standard incoming components. With this information, you or your G-E distributor can determine the General Electric integral

PRIMARY 480 VOLTS WITH (2) 21/2 % TAPS ABOVE AND BELOW NORMAL—SECONDARY 208Y/120 VOLTS (WITH TERMINAL COMPARTMENT ONLY)

	BASIC	SPECIFICATIONS FOR			TERMINA	RTMENT	
KVA	LINE		ALL MODE	.5	SPECIFIC		
	NUMBER	Hr.	Depth	Мах Х	UNIT NUMBER	WIDTH	WEIGH
75	9T26Y	78	37 1/2	24	2000	56	1870
112.5	9726Y	78	371/2	36	2002	72	2340
150	9T26Y	78	371/2	36	2004	72	2630
225	9T26Y	78	37 1/2	42	2006	80	3210

DETERMINE THE USE, AND THE REST IS AUTOMATIC. The General Electric Handbook contains all the necessary ordering information and prices in chart form—similar to the above, but more complete for other ratings.

distribution center you need from the information given in the G-E Handbook. The only other step necessary to complete the order is to specify the molded case breakers for the secondary breaker panel. Complete information for specifying breakers is also given

in the General Electric Handbook.

FOR MORE INFORMATION, call your nearest General Electric distributor. Or, write to section 410-46, General Electric Company, Schenectady 5, New York for a fact-filled bulletin on General Electric integral distribution centers.

Progress Is Our Most Important Product

GENERAL E ELECTRIC



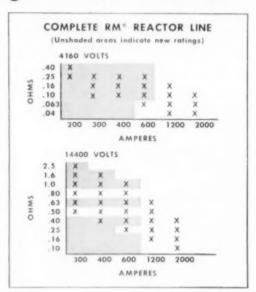
General Electric offers 8% lower prices, faster delivery in 24 new ratings of RM* reactors

8% PRICE REDUCTION and two to three weeks shorter shipment, possible for years with G.E.'s Repetitive Manufacture (RM) reactors, are now available in 24 new ratings up to 2000 amperes in both the 4160- and 14,400-volt classes. This means major savings in your most-required protective ratings.

RM REACTORS HELP PROTECT COSTLY EQUIPMENT and reduce system expansion costs by helping limit short-circuit currents to the capacity of other components. For this reason, G.E.'s reactor ratings are designed to coincide with the standard short-circuit ratings of switchgear, regulators, and other system equipment.

opportunities for savings exist throughout your system. Feeder protection, bus sectionalizing, bus synchronizing, and neutral grounding are only a few of the applications where G.E.'s complete line of reactors can help reduce equipment investment. Full details are available from your G-E Sales Engineer or from Section 422-38, General Electric Co., Schenectady 5, N. Y.

Repetitive Manufacture



Progress Is Our Most Important Product



Plan now to use G-E TRI GCLAD motors in ratings to 125-hp

Increased production throughout U.S. industry has created a demand for more powerful machines with greater speeds and increased capacity. To meet this demand, General Electric will soon announce a wider range of Tri-Clad '55' motors in compact . . . power-packed dimensions.

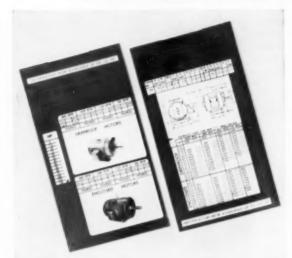
ADVANCE INFORMATION—Experienced engineers and skilled craftsmen have utilized revolutionary new materials and the most modern production techniques to pack more power into these larger G-E motors built to new NEMA standards. The more rugged, higher horsepower motors will feature easy installation, reduced maintenance, and long-life performance.

PLAN AHEAD—New Tri-Clad '55' motors can mean real savings in your plant modernization project and in new product design. For complete details on the wider range of motors, contact your nearest General Electric Apparatus Sales Office. For advance size information, send in the attached coupon for free slide rule. General Electric Company, Schenectady 5, New York.

Progress Is Our Most Important Product

GENERAL 🚳 ELECTRIC

FREE SLIDE RULE ADVANCE INFORMATION TO HELP YOU PLAN AHEAD



FREE SLIDE RULE—Write for free slide rule which lets you determine at a glance the weight and space-saving benefits of new Tri-Clad '55' motors up to 125-hp. This handy slide rule provides advance information to solve your design problems . . . to benefit your over-all operation.

32611	ON F891-2
GENE	RAL ELECTRIC COMPANY
SCHE	NECTADY 5, NEW YORK
of Tri-	d like advance information on new dimensions Clad '55' motors up to 125-hp. Please send e slide rule.
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Edwards

ZONALARM

opens new opportunities for contractor profit

Introducing Zonalarm...the exclusive new product that opens brand new areas for your business! A low-cost, automatic fire-alarm system designed and *priced* to meet the needs of larger homes, farms, small institutions and business establishments.

Zonalarm is a fully automatic system that not only warns of fire, but pinpoints the location so that effective steps may be taken immediately. A low-voltage system, Zonalarm is easy to install, requires virtually no maintenance. Its built-in test buttons assure the user of constant dependability. In case of power failure, unit automatically switches over to battery operation. Zonalarm is the first full-scale automatic fire warning system you can install for under \$200.00.

There are large markets in your area that need and will want Zonalarm. For full information see your Edwards Distributor, contact your Edwards salesman or write Dept. EC-6, Edwards Company, Inc., Norwalk, Connecticut. (In Canada: Edwards of Canada, Ltd., Owen Sound, Ont.)













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Specialists in Signaling since 1872

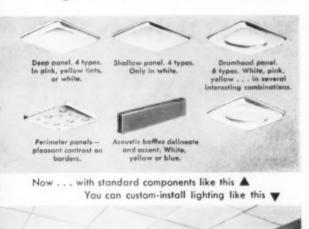




This dynamic new area-illumination system offers unlimited design freedom with standard components

Sylvania introduces Sylva-Lume

wall-to-wall lighting system



Complete Flexibility. Entire ceiling design can be changed easily, if desired, by re-arranging panels and baffles . . . to

with overall interior décor changes.

engineer unlimited potentials for variety of lighting plans. With Sylva-Lume, new product excitement lies at your fingertips. You can give customers the newest, the finest, the most exciting

Announcing Sylva-Lume, a new

tool for overall area illumination,

giving the contractor and lighting

est, the finest, the most exciting lighting available today. You can custom-build over 100,000 different lighting patterns... using only standardized components... based on 36-inch modules.

Sylva-Lume brings more of the designer's, or the customer's, own individuality into the layout. He can organize its elements of color,

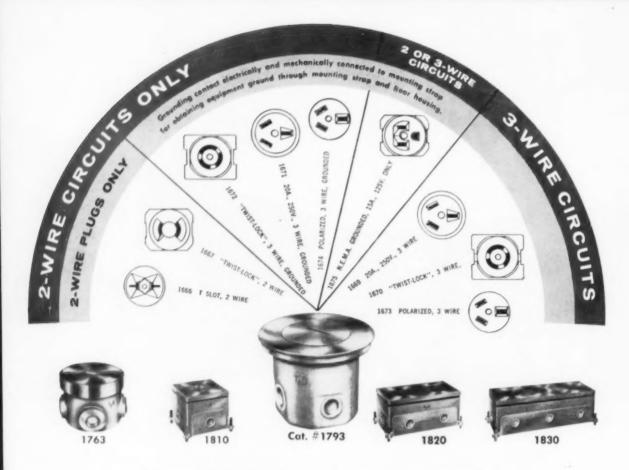
light and form . . . get pattern, texture, mood and style, as he wishes. And he can quickly change over color and patterns periodically or seasonally.

Sylvania engineers, assisted by Peter Muller-Munk Associates, noted industrial designing firm, have now brought this artistically conceived creation into the realm of engineering practicality. Write direct for folder of complete information.

SYLVANIA ELECTRIC PRODUCTS INC Department F40 Lighting Division – Fixtures One 48th Street, Wheeling, W. Va.

SYLVANIA.

...tastest growing name in sight
LIGHTING • RADIO • ELECTRONICS • TELEVISION • ATOMIC EMERGY



New! T&B floor box receptacle

MATCHES YOUR CIRCUIT WIRING AND THE PLUG ON YOUR EQUIPMENT

Here's a convenient money saver from T&B . . . designed to make the use of many types of receptacles easier and more readily available. T&B receptacles (there's one for every need) fit all T&B floor boxes . . . and they can be changed in a matter of minutes should you later install equipment

which requires a change in receptacles.

For full information on T&B floor boxes and receptacles, contact your T&B distributor today — he will show you how to save money on installed costs, save time, and safety-ize your job with T&B floor box receptacle combinations.

LOOK FOR THE SIGN -



IT'S THE MARK OF AN AUTHORIZED T & B DISTRIBUTOR

The complete line of T & 8 fittings for conductors and raceways is sold only by recognized electrical wholesalers. It's our way of assuring you the service and savings of a friendly local source. Call him for all your electrical needs.

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INCORPORATED

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Thomas & Betts Ltd., Montreal, P.Q., Canada
MANUFACTURERS OF FINE ELECTRICAL FITTINGS SINCE 1898



Here's Another LITECONTROL "Bank Statement" about High Efficiency Lighting

The work areas... the traffic areas, even the pictures on the wall, are glarelessly illuminated in this bank installation at Greenfield, Mass. Our brand new Litecontrol 7300RS series fixture with the Holophane #6024 lens was used to assure high efficiency, low brightness and ease of maintenance by means of the hinged door.

An intriguing special note is the absence of the plastic side panels usually in evidence. This accents the attractiveness of this installation . . . lending a belief that the fixtures are recessed instead of surface mounted. Deluxe cool white lamps provide the light source.

So once again, imagination in illumination pays off without a high lighting

budget. You can obtain similar results with standard Litecontrol fixtures. For banks, offices, stores, schools, libraries — any public building. Greenfield Savings Bank, Greenfield, Mass.

AREA:
Moin Bonking area.

ARCHITECT:
Mowe, Proof & Ekman, Providence, R. 1.
GENERAL CONTRACTOR.
Thomas J. Gass Company, Inc., Greenfield, Mass.

ELECTRICAL CONTRACTOR: Clark Electric Company, Greenfield, Mass. LIGHTING ENGINEER: C. J. Forster, Jr., Western Massachusetts Electric Company, Greenfield, Mass.

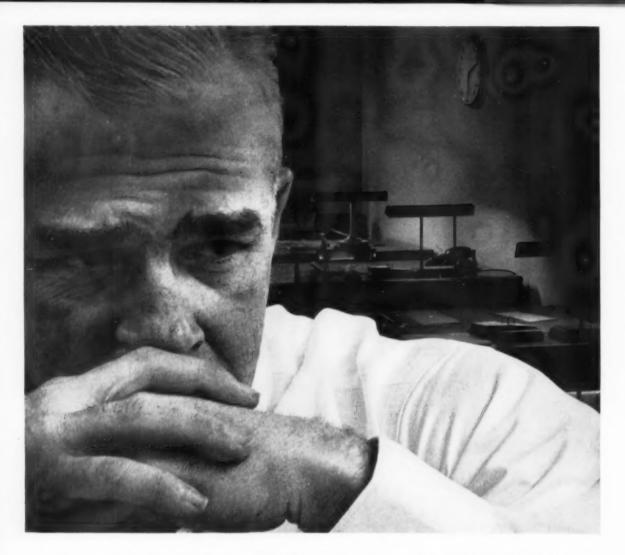
CELING HEIGHT: 9'-6".
FIXTURES.
Litecontrol No. 7344RS 4 lamp surface mounted, with steel sides, using Holophone No. 60'24 acrylic lennes and deluxe cool white lamps.

INTENSITY: Average 80 foot-candles initially,

LITECONTROL Fixtures

LITECONTROL CORPORATION, 36 Pleasant Street, Waterlown 72, Massachusetts

DESIGNERS, ENGINEERS AND MANUFACTURERS OF FLUORESCENT LIGHTING EQUIPMENT DISTRIBUTED ONLY THROUGH ACCREDITED WHOLESALERS



Do you worry about conduit space for new control circuits

AFTER EVERYONE'S GONE HOME?

If you have a problem in getting additional control circuits in existing conduits — here's one practical way to solve it — specify and use Rockbestos PNR 600 volt control cable. It will help you get a maximum number of control circuits in a minimum amount of space. Here's why:

- Rockbestos PNR lets you pull a 12 conductor control cable in conduit which
 is now carrying ordinary six or seven
 conductor cable.
- It's 46% smaller in area 28% smaller in diameter than conventional control cable.
- With it you save on conduit and fittings, cut installation costs.
- It's flexible from 167° to -67° F.
- It's light, easy to handle, pull through conduits.

Get the complete Rockbestos PNR story
— write now for catalog which gives complete specifications and application data.

ROCKBESTO NEW HAVEN 4,

ROCKBESTOS PRODUCTS CORPORATION

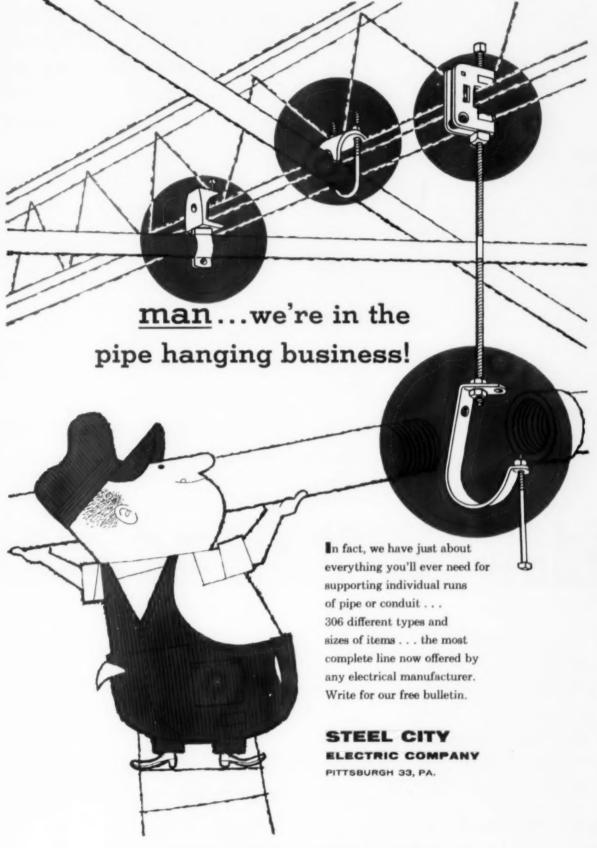
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ROCKBESTOS



PNR
Small Diameter
Control Cable

MORE THAN 10,000,000 FEET IN SERVICE



TROFFER: A RECESSED FLUO-RESCENT LIGHTING UNIT THE NEW WAKEFIELD TROFFER 490 IS A STANDARD PACKAGED UNIT THAT OFFERS 490 COMBINATIONS

THE OVER-ALL DEPTH OF UNIT IS 4-7/8 IN.

ALL ELECTRICAL COMPONENTS
BALLASTS, SOCKETS AND WIRE
ARE THE HIGH WAKEFIELD QUALITY

THE BODY IS ONE PIECE AND IS THE STANDARD WAKE-FIELD 20 GAUGE CONSTRUCTION

REFLECTING SURFACES ARE INFRA-RED BAKED ENAMEL WITH 0.85 REFLECTION FACTOR

THE WAKEFIELD

ALL UNITS ARE AVAILABLE FOR FLANGE, SNAP-IN AND LAY-IN TYPES OF CEILINGS

THE UNITS ARE IN COMPLETE PACKAGES WITH HANGER YOKES

WIDE RANGE OF REASONABLE PRICES MODULAR UNITS
DO NOT GROW IN
LENGTH WHEN
UNITS ARE USED IN
CONTINUOUS ROWS

7 TYPES OF LIGHT CONTROL
NO. 70 CORNING LOW BRIGHTNESS
LENS—ACRYLIC AND STYRENE
DIFFUSING PLASTICS—VINYL
PLASTIC—STYRENE LENS—
35×35 DEGREE LOUVERS AND
SKYTEX DIFFUSING GLASS

490 OFFERS YOU COMPLETE FLEX-IBILITY IN THE DESIGN LAYOUT AND MATCHING COST BUDGETS

TROFFER 490

FAST ACCURATE UNIT INSTALLATION 2 LEVELING BOLTS ON EACH YOKE

THE WAKEFIELD COMPANY
OF VERMILION OHIO USA
AND LONDON ONTARIO

NO LIGHT LEAKS AROUND DIFFUSER ECON dual-element cartridge fuses combine

EXTRA PROTECTION

with "QUICK as a WINK" ACTION!





Here's the plastic tape that gives complete protection—both mechanical and electrical. Made to order for tight spots, this tape makes thin splices, keeps wiring neat and uncluttered. Royalastic does the work of both rubber and friction tapes. It offers high tensile strength, good stretch, and excellent resistance to water, oils, acids, alkalies and corrosive chemicals. It has a good appearance, pulls down tight and stays on. Approved by Underwriters' Laboratories, Inc.

stays on. Approved by Underwriters' Laboratories, Inc.
For quick delivery of Royalastic Tape, get in touch with any of our selected distributors, or any of the 28 "U. S." District Sales Offices, or write us at Rockefeller Center, New York 20, N. Y.

In Canada, Dominion Rubber Co., Ltd.

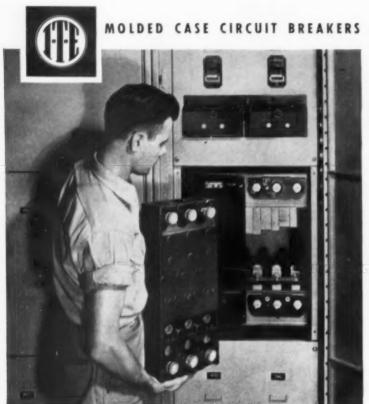




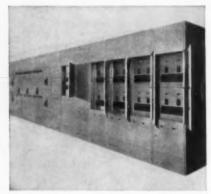
Mechanical Goods Division

United States Rubber

SEE THINGS YOU NEVER SAW BEFORE, VISIT U.S. RUBBER'S NEW EXHIBIT HALL, ROCKEFELLER CENTER, N.Y.



I-T-E plug-in mounted "Cordon" Circuit
 Breakers represent the maximum in flexibility, economy and safety.



Typical switchboard installation of "Cordon" Circuit Breakers and large air circuit breakers.

I-T-E Plug-In Mounted "Cordon" Circuit Breakers Have Saved Countless Man-Hours

Plug-in mounting in switchboards provides features and advantages you get only in this modern, streamlined construction. Consider the ease of installation, the time saved in assembling switchboards. Consider the flexibility in meeting changing circuit conditions, the advantage of being able to change breakers without disturbing terminal connections. Consider, too, the added safety of concealed terminals with no live parts exposed. When you do, you'll specify switchboards with this time-proved method of installing molded case circuit breakers.

I-T-E plug-in molded case circuit breakers are available in ratings from 15 to 600 amp, up to 600 volts a-c, 250 volts d-c. Contact your I-T-E representative or leading independent switchboard manufacturers for details. Or write I-T-E Circuit Breaker Company, 19th & Hamilton Sts., Philadelphia 30, Pa.



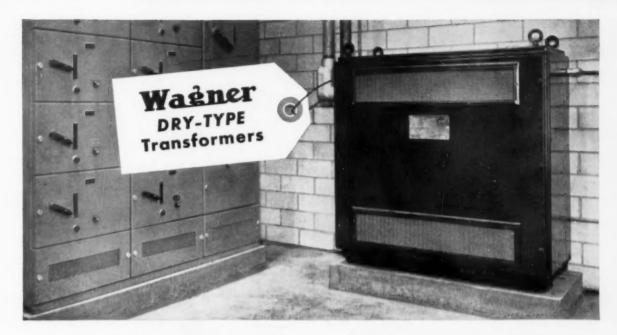
Used for many years in marine switchgear and approved by Underwriters' Laboratories Inc., I-T-E plug-in mounted circuit breakers require only two compact mounting blocks for switchboard installation.

I-T-E CIRCUIT BREAKER COMPANY

Small Air Circuit Breaker Division

In Canada, Eastern Power Devices Ltd.





Put the right voltage where you need it!

NO EXPENSIVE RE-WIRING. Wagner dry-type transformers, when installed close to your machines, portable tools, and lighting circuits, give you the right voltage for use directly from 460 or 600 volt power lines. No re-wiring is necessary—line losses are reduced—installation costs are low.

SAFE TO USE—EVEN IN HAZARDOUS AREAS. You need no fireproof vaults or other protective enclosures, since Wagner dry-type transformers meet all safety requirements for indoor installation. These transformers are liberally designed to carry overloads safely in emergencies.

PROVIDE FLEXIBILITY FOR CHANGING REQUIREMENTS.

Dry-type transformers, 3 through 300 kva, are built with Wagner Form W core and coil assemblies. This design permits less weight per kva with correspondingly small cases that are easy to install—easy to move whenever changes in plant facilities are required.

ECONOMICAL TO MAINTAIN. These units have no liquids, valves, gaskets, or gauges to cause maintenance problems. The totally-enclosed types are completely sealed from all contaminating materials by sheet steel cases. Maintenance is reduced to the minimum.



Single-phase, 150°C Rise. 3 through 50 kva. Silicone insulated, totally-enclosed, non-ventilated. For indoor or outdoor use. 80°C Rise. —15 through 100 kva. For indoor use only.

T57-12



Three-phase, 80°C Rise. 9 through 300 kva. Ratings through 30 kva are suitable for indoor or outdoor use. Larger ratings are for indoor use only.



Single-phase, 55°C Rise. 1, 1 ½ and 2 kva. For indoor or outdoor use. Bulletin TU-57 gives full information. Write today.

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BRANCHES AND DISTRIBUTORS IN ALL PRINCIPAL CITIES

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ELECTRIC MOTORS . TRANSFORMERS . INDUSTRIAL BRAKES . AUTOMOTIVE BRAKE SYSTEMS - AIR AND HYDRAULIC

ELECTRICAL CONSTRUCTION AND MAINTENANCE . . . JUNE, 1957

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LE Series (Class I, Groups C and D) 60 to 500 Watts Choice of body and reflector styles

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CONDUIT FITTINGS . PLUGS AND RECEPTACLES . TURBO-GENERATORS . MULTI-VENT AIR DISTRIBUTION

ELECTRICAL CONSTRUCTION AND MAINTENANCE . . . JUNE, 1957



For SATISFYING Power Company and Application Requirements...

BULLETIN **646**manual autotransformer Type

A strictly "modern" starter. Silver alloy, air break contacts provide long, trouble free life... without the messiness and maintenance of oilmmersed contacts. Operation is simple... a bell signals proper interval—which can be adjusted—for switchover from START to RUN. Air break contacts standard in ratings to 75 hp, 220 v; 150 hp, 440-550 v. Also furnished oil-immersed up to 125 hp, 220 v; 250 hp, 440-550 v.



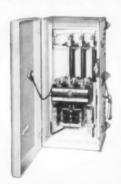
BULLETIN **746**automatic autotransformer Type

Employs autotransformer connected in delta to reduce line voltage for starting squirrel cage motors that should not be started on full line voltage. Automatically operated by solenoid contactors with double break, silver alloy contacts. Adjustable timing relay controls accelerating period. Taps are provided on the autotransformer to adjust the motor starting voltage. Ratings up to 300 hp, 220 v; 600 hp, 440-550 v.



For Velvet S-M-O-O-T-H STARTING ... nothing equal on the market!

BULLETIN **640**manual stepless resistance TYPE



Graphite compression disc resistors provide smooth, stepless starting of polyphase squirrel cage motors. Operated by hand lever, the smooth starting of the motor is under the control of the operator. Limits starting current and prevents lamp flicker. Accurate overload relays protect motors against burnout. No-voltage protection provided. Ratings to 200 hp, 220-440-550 y,

8-57-MR

BULLETIN **740**automatic stepless resistance Type



Preset and adjustable graphite disc resistors are automatically inserted in series with squirrel cage motor at starting. Adjustable timing relay operates contactor, which automatically cuts out resistors after predetermined starting period. Resistors can be adjusted to motor and load conditions for velvet smooth acceleration. Accurate thermal relays protect motors. Ratings to 200 hp, 220-440-550 v.

Write for Bulletin



Allen-Bradley Co. 1316 S. Second St. Milwaukee 4, Wis.

In Canada— Allen-Bradley Canada Ltd. Galt, Ont. ALLEN - BRADLEY
MOTOR CONTROL

/see

page

...and still other ALLEN-BRADLEY reduced voltage starters

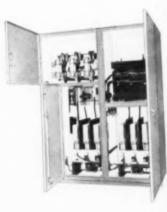
BULLETIN 736 ... AUTOMATIC part winding TYPE



For use with squirrel cage motors having two separate parallel stator windings. Provides economical reduced voltage starting when starting current does not exceed power company limitations. Two types—Style A is a 2-step starter available in ratings up to 200 hp, 220 v; 400 hp, 440-550 v. Style B is a 3-step starter with resistance in the first step. In ratings up to 200 hp, 220-440-550 v.

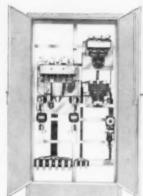
BULLETIN 1172...AUTOMATIC high voltage, air break reactor TYPE

For starting high voltage squirrel cage motors at reduced voltage. Simple solenoid air break contactor has only one moving part, and the double break. silver alloy contacts need no maintenance. These contactors are designed for heavy duty industrial service and can be used for inching or jogging. Reliable overload relays protect the motor at all times. Starters have interrupting capacities of 150,000 kva, 2300 v; 250,000 kva, 4600 v. Made in ratings up to 1500 hp, 2300 v; 2500 hp, 4600 v.



BULLETIN **741**...AUTOMATIC multipoint resistance Type

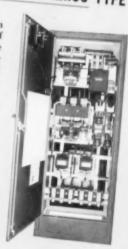
An automatic starter that will satisfy power company requirements for starting of motors on network systems. Resistances are automatically inserted in the line at starting, and are short circuited in steps at definite time intervals. Time intervals can be adjusted from 1 to 5 seconds for ideal starting under various load conditions. Available in 2, 3, and 4-point starters. Made in ratings up to 300 hp, 220 v; 600 hp, 440-550 v.





BULLETIN **742**...AUTOMATIC stepless, graphite resistance Type

This is the ultimate in smooth acceleration of squirrel cage motors. The graphite disc resistors vary in resistance smoothly and steplessly as the pressure on them is automatically changed. Also, the rate at which pressure is applied can be varied over a wide range. Lamp flicker on network systems used for both power and light is completely eliminated. Also ideal where a starting shock to driven machines may cause serious trouble or affect machine life. Ratings to 200 hp, 220-440-550 v.





MOTOR CONTROL

Allen-Bradley Co.
1316 S. Second St., Milwaukee 4, Wis.
Canada—Allen-Bradley Canada Ltd., Gait, Ont.



Mr. Carey (seated) discusses plans for his new Harvey Park Addition in Denver with his sales manager, Morris Gilligan, and David R. McMillan (also seated) of Mountain States Telephone and Telegraph Company.

"Concealed telephone wiring is a proven sales feature"

-says Mr. J. J. "Lou" Carey, Builder, of Denver, Colorado

"More and more customers are asking for concealed telephone wiring," says Mr. Carey. "It's one of the conveniences and refinements they expect to find in a modern home.

"Concealed telephone wiring is a proven sales feature because the American public wants more telephones. They want these telephones located handily and the wiring concealed. Our slogan is 'The Best Planned Home We Can Build,' and that certainly includes telephone planning."

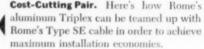
In his eleven years as a builder, Mr. Carey has been associated with the construction of more than 3000 homes. At present he is at work on 450 more. He is a past president of the Home Builders Association of Metropolitan Denver, and is a National Director of NAHB. In company with trend-minded builders across the country, Mr. Carey is convinced of the value of concealed telephone wiring as a quality sales feature.

Your nearest Bell Telephone business office will help you with concealed wiring plans. For details on home telephone wiring, see Sweet's Light Construction File, 8i/Be. For commercial installations, Sweet's Architectural File, 32a/Be.

Working together to bring people together BELL TELEPHONE SYSTEM









Additional savings on your service drops now possible with Rome's aluminum Triplex

You can reduce the cost of overhead distribution service by installing Rome's aluminum Triplex. Here's how it saves you money:

 Costs less. Initial cost is lower than conventional copper Type SD service drop cable.

2. Cuts down installation time. Because of its light weight, Rome's aluminum Triplex is easier to handle and install. 3. Lasts longer. Maintenance and service interruptions are few compared to open-wire installations. It offers maximum resistance to storms, wind, and ice loading.

Specify Rome's aluminum Triplex for your next service drop installation. Contact your nearest Rome Cable representative for more information—or write to Department 364-A and ask for Bulletin RS-5.



If voltage drop is not a problem ...

Save up to 15% on cost of 100-amp service for new housing with Rome's improved SE cable

You can now substitute No. 3 AWG copper conductors for the more expensive No. 2 AWG in 100-ampere service locations where voltage drop is no problem. U/L approval of Rome's improved Type SE service entrance cable for 75°C. operation makes this dollar-saving substitution possible. You can save up to 15% of the cost of installing 100-ampere service.

Easy to use. Approved for hightemperature operation in *either dry* or wet locations when insulated with Rome's heat- and moistureresisting compound. You'll find Rome's Type SE cable easier to handle because of its lighter weight. Saturated cotton braid—one red and one black—over each conductor provides quick and positive conductor identification. Its neat, neutral-gray finish readily blends with the outsides of most homes, and it can easily be painted when necessary. The over-all outer braid is both flame-and moisture-resistant; and—for

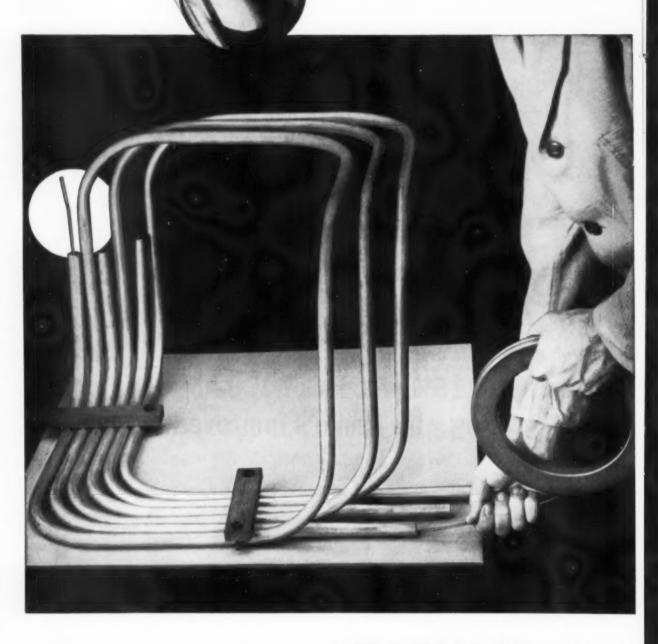
identification—it's surface-printed: "SE-Style-U 75°C." It resists becoming tacky, even under severe storage conditions.

Specify Rome's service entrance cable for your next job. Contact your nearest Rome Cable representative for more information—or write to Department 364-A and ask for Bulletin SE-1. Rome Cable Corporation, Rome, New York.

ROME CABLE

CORPORATION

New Rome EMT



Fish-Tape Slips Right Through Rome EMT. No amount of forcing would get a ½-inch fish tape through two competitive lengths (behind Rome EMT). Here the same tape is shown as it slides right past all eight 90-degree bends in the Rome EMT.

proved best in fish-tape test

Actual comparison test proves Rome EMT easiest to fish

In recent tests, Rome Cable's EMT came out first in fishability. Disinterested observers checked the results with X-ray photos.

How the test was conducted:

Disregarding the National Electrical Code's limit of four bends, technicians bent a whole series of tenfoot lengths of ½-inch EMT into identical eight-turn runs for testing purposes.

A standard 1/8-inch fish tape was then run into the test samples. It went easily through all eight bends in Rome EMT. In every competitive sample, the tape stuck fast at one of the bends!

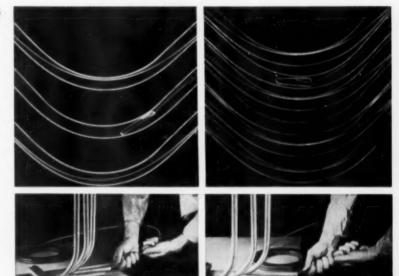
Why Rome EMT is easiest to fish

A shiny new interior lets fish tapes slide through with an absolute minimum of resistance. Careful baking—under rigid control—puts a uniformly smooth enamel finish inside Rome EMT.

Test it yourself

Pick any competitive EMT, bend it identically with a length of Rome EMT, and then try the fish-tape test. You'll find that Rome Cable wins every time in this test of direct comparison.

Specify Rome EMT for your next job. Contact your nearest Rome Cable representative for more information—or write to Department 902, Rome Cable Corporation, Rome, N. Y.



Manufacturer "A" A 1/8-inch fish tape is being forced into this competitor's EMT. The X-ray photo (top) shows how the tape stuck fast on the fourth bend—as a result of a high-friction inside finish.

Manufacturer "B" The same fish tape is being run into another competitor's EMT. The X-ray photo shows the tape—stuck here on the seventh bend. Inside surface resistance caused this tape to stick.



Disinterested Observers from the Anstice Co., Inc., Rochester, N. Y., take X-ray photographs during tests. The photographing was witnessed by Chester Uffelman, Notary Public.

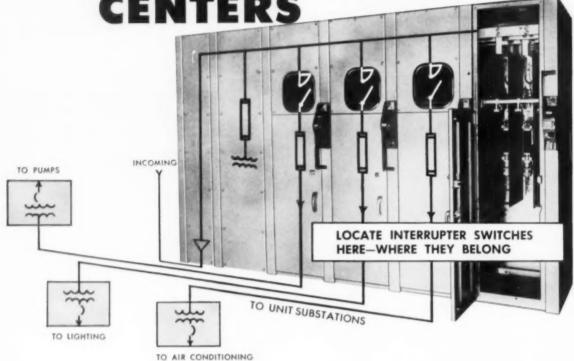
STOCK DISTRIBUTION CENTERS

Atlanta, Ga.
Chicago, III.
Dallas, Texas
Denver, Colo.
Houston, Texas
Kansas City, Mo.
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Rome, N. Y.
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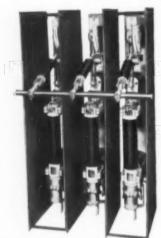
ROME CABLE

CORPORATION

R&IE
POWER SWITCHING
CENTERS



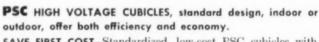
Cost Less Save Space Easier to Maintain



FUSED HPL-C INTERRUPTERS

Ratings-up to 14.4 Kv (110 BIL) 600 Amp. (40,000 Mom.), 1200 Amp. (60,000 Mom.)

Specify TOG-L SNAP operating mechanism for closing- in fault protection.



SAVE FIRST COST—Standardized, low-cost PSC cubicles with HPL-C fused interrupters, feature sectional main bus—providing compact flexibility. PSC means lower cost per feeder than scattered locations of switches in unit substations.

SAVE SPACE—With dry type load center transformers, PSC can save many square feet of floor space at the unit substation location. They also may be mounted overhead, saving additional floor space.

EASIER TO MAINTAIN—Easily operated, accessible for inspection. Can be handled with any maintenance crew.

PROTECT SYSTEM—Against faults in cables as well as transformers.

ADD FEEDERS any time-up to 1200 Amp. total load.

Ask your I-T-E Representative to show you the many PSC economies. Data available.

R&IE EQUIPMENT DIVISION

I-T-E CIRCUIT BREAKER CO. GREENSBURG, PA.

PSC - 9

NOW! ROYAL PVC CAPS and CONNECTORS



ONE-PIECE CONNECTORS

HIGHEST QUALITY

SREER, STRONGER



TWO and THREE-WIRE Service,

THE GREATEST ENGINEERING ADVANCE IN CAPS AND CONNECTORS IN YEARS!

Here's a brand new concept in cap and connector engineering, so unusual that it's revolutionizing the industry, so simple that it's fool-proof!

All contacts are anchored in unbreakable, chip-proof, crackproof vinyl, without screws, eyelets or rivets; the construction of both caps and connectors creates new standards for ease of wiring, speed, safety and durability.

SEE FOR YOURSELF!

Compare the advance-design features of PVC with what you've been using. ORDER FROM YOUR WHOLESALER, or write on your company letterhead for a FREE SAMPLE. Once you try PVC, you'll use nothing else.



ROYAL ELECTRIC CORPORATION



Simple wiring instructions on individual fact tags

PAWTUCKET, RHODE ISLAND

MICRO SWITCH ... FIRST IN PRECISION SWITCHING

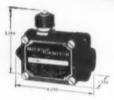


How to cut
processing costs
by making
plant equipment
MORE
AUTOMATIC
...MORE
PRODUCTIVE



Write for Catalog 83 on "Industrial Enclosed Switches"

Here are some important uses
plant operating men find for
MICRO SWITCH Precision Switches
as keys to automatic plant controls

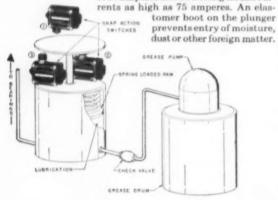


Three switches keep motor bearings oiled on large mixing machine

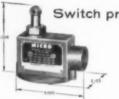
As grease is forced out of the lubricator, the disc on the extended portion of the piston rod actuates Switch 2.

This energizes a pump relay, pumping grease into the lubricator. When this is full, the disc actuates Switch 1 which stops the pump. Switch 3 is set lower than Switch 2. If the pump fails to start, the disc descends until it hits Switch 3 which sets off an alarm.

This MICRO SWITCH Type F is a high-capacity switch capable of making and breaking steady state currents of 20 amperes and switching inrush cur-



MICRO SWITCH precision switches for plant use
applications are available at authorized distributors
in key cities everywhere. Look under "Switches,
Electric" in the Yellow Pages.

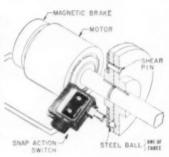


Switch protects against damage if shaft binds or jams

A plant engineer installed this roller-plunger switch on a shear pin coupling to prevent serious mechanical damage should the driven shaft bind or jam.

Three equally-spaced steel balls bear into drill point seats in the driven disc. The balls are retained in holes in the driving disc by a spring-loaded ring. When the pin shears, the ball moves out of the drill point seats. This lifts the spring-loaded ring which actuates the switch and stops the motor.

The switch used in this application is a MICRO SWITCH Type E switch with a roller-plunger actuator. This switch is designed for camor slide operation in applications where the approach of the actuating device is in the same direction as the longitudinal axis of the switch.



You can make your machinery more automatic by using these switches for—

Process controls • Conveyor controls • Bulk flow controls • Level controls • Counting controls • Weight controls • Motion controls

MICRO SWITCH

A DIVISION OF MINNEAPOLIS-HONEYWELL REGULATOR COMPANY
In Canada, Leaside, Taranto 17, Ontario • FREEPORT, ILLINOIS



SELLING PLUSSES for You...

SERVICE PLUSSES for Your Customers





CANOPY EXTENSION UNITS

Add-a-Pipe Lengths: 6", 12", 24", 36". Add-a-Flextension Lengths: 12", 18", 24". Curved Arm Pipe Lengths: 12" and 24". Also pre-assembled Canapy Units complete with Straight, Curved or Flexible Extensions.





BULLDOG TROLLEY and WIREMOLD UNITS

Completely assembled Swivelite Socket Units for easy positioning at any point on horizontal or vertical Bulldog Trolley Ducts. Types for #2100 and #3000 Wiremold Raceways.

amplex

Swivelite Line

SOME OF THE FEATURES

SOME OF THE FIXTURES

L DOUBLE-BALL SWIVEL

Exclusive free-floating universal joint swivel gives your customers instant, positive fingertip positioning of lamps at any angle.

2. LUSTROUS, LASTING FINISH

The infra-red baked Deluxe Satin Aluminum Finish gives lasting satisfaction — won't chip, discolar or blister.

3. AIR FLOW VENTILATION

Your customers get longer lamp life because the 8 ventilating ports in Swivelite hoods carry off excess heat, keep lamps cooler, reduce tendency for bulb bases to loosen.

4. "ADAPT-A-UNIT" CONSTRUCTION

You can easily change Swivelite installations to meet changing needs of your customers—by adding, removing, interchanging Add-A-Pipe, Add-A-Flextension or Curved Arm Pipe Lengths.

Recommend amplex lamps for amplex fixtures



COLORBEAMS will give your customers endless opportunities for colorful, dramatic accent lighting, easily keyed to changing seasons. 8 brilliant, sparkling, guaranteed permanent colors in indoor bulbs; 10 in indoor-outdoor.



SPOTLITES and FLOODLITES fill every need for lighting single objects or entire areas. 40 to 500W for indoor service; 75 to 1,000W for outdoor.

Your distributor carries the complete line of amplex fixtures—also the complete line of amplex incandescent and fluorescent lamps for standard and specialized lighting needs.

for descriptive literature, write

amplex

CORPORATION
Dept. EC 2-57
1111 WATER STREET
BROOKLYN 1, N. Y.

SMOOTH BORE!



Orangeburg Fibre Conduit Prolongs Cable Life

Protect cable sheath from abrasion and you prolong the life of underground cables, say utility engineers. Scoring of cable sheath creates "trouble spots" that shorten cable life.

That's where Orangeburg Fibre Conduit plays an important part in keeping cables healthy. Orangeburg's smooth bore, its low coefficient of friction minimize the danger of abrasion when cables are pulled in, as well as later on during cable movement. By protecting cable sheath from abrasion, Orangeburg Fibre Conduit adds years to cable life.

Orangeburg's impermeable wall and watertight joints protect cables from corrosive ground waters. Its nonmetallic material is strong, tough, resilient, long lasting.

And, remember, Orangeburg lays faster and at lower cost than other types of conduit. It is light in weight, easy to handle, easy to tool on the job. Spacers, bends, fittings, 5° bend sections and lightweight tapering tool, all combine to simplify installation.

Since 1893, records of long life have proved Orangeburg's durability and economy.

Orangeburg Fibre Conduit is distributed by Graybar Electric Company and General Electric Supply Company with branches and stocks in principal cities.

WRITE DEPT., EC-67 FOR NEW CATALOG 52.

ORANGEBURG MANUFACTURING CO., INC., Orangeburg, N. Y. W.

West Coast Plant, Newark, Calif.

ORANGEBURG'

SELF SEALING

TAPER JOINT

working with the electrical contractor on today's school building projects . . .



4/5 mile of apri lighting units

. . . every inch designed with your installation problems in mind

Quick, easy installation is an important part of every Benjamin design... and Capri is no exception. Capri is engineered to install quick, fit right and meet any special installation requirement. All this adds up to lower installation costs for the buyer ... assured profits for the installing contractor. Benjamin Electric Mfg. Co., Des Plaines, Ill.

WEST PENSACOLA HIGH SCHOOL

Arrhitect FRANK J. SINDELAR, A. I.

Consulting Engineers: EVANS & PHILLIPS

Contractor DYSON & Co., Pensacola, Fla.
Electrical Contracting: BAROCO ELECTRIC
CONSTRUCTION CO., Pensacola, Fla.

вищеся

BENJAMIN

. . . always the source of good lighting

IN DALLAS...JIM LING KNOWS THAT WITH



The tremendous success of Ling Electric, second largest electrical contracting firm in the Texas-California areas, is a personal tribute to the know-how and experience of Jim Ling, president. And here's what Mr. Ling has to say about Republic's E.M.T.:



TIME DE ELECTRICAL CONTRACTORS .

December 26, 1956

Republic Steel Corporation Steel and Tubes Division 224 East 131st Street Cleveland, Ohio

We would like to take this opportunity to comment on our recent experience with your electrical products. We have used recent experience with your electrical products, we have used Republic ELECTRUNITE "INCH-MARKED" E.M.T. on our last

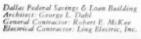
The Republic distributors and salesmen worked closely four large jobs in Dallas with our organization to set up necessary delivery schedules and other pre-construction details. All of the deliveries were made as scheduled and material was on the job as needed.

Our men in the field are well pleased with Republic products. They find the ELECTRUNITE E.M.T. easy to bend and have had no trouble with the finish. The "INCH-MARKED" and mave mad no trouble with the timesh. The "ENCH -MAP and "GUIDE-LINE" features of your E.M.T. spoke for

All of these features enable our electricians not only to do their work faster and with less waste, but also to make a themselves neat and work manife installation that means so much to our Thank you for your past cooperation and fine products. customers.

12444

James J. Ling President





JJL/dc

REPUBLIC



World's Widest Range of Standard Steels

Republic ELECTRUNITE E.M.T.

The Best Costs LESS INSTALLED



Republic ELECTRUNITE E.M.T. is easy to install . . . reduces construction costs . . . builds greater customer satisfaction . . . because back-to-back and saddle bends are as easy as 1-2-3!

- 1. Follow the "INCH-MARK" for fast, accurate measuring every time.
- 2. Cut the desired length with no muss ... no fuss.
- 3. Exclusive "GUIDE-LINE," which extends the full length of the raceway, simplifies the bending operation. Just align

the arrows on the Republic Calibrated Bender and apply minimum pressure.

Bends are true and accurate-eliminate costly "wows" and avoid waste.

Try Republic ELECTRUNITE E.M.T., available in popular sizes, on your next job. Be sure to ask your electrical distributor for Republic E. M. T. that is "INCH-MARKED" and "GUIDE-LINED"-your assurance of uniform quality, ductility, dimensions.

Write for illustrated literature and specifications today!





STEEL

and Steel Products

REPUBLIC STEEL CORPORATION STEEL AND TUBES DIVISION DEPT. C-4165

212 EAST 131st STREET . CLEVELAND 8, OHIO

Please send me additional information on Republic ELECTRUNITE® "INCH-MARKED" E.M.T.

Company-Address

of these poles do the work of 24 at Memphis' **Newest Shopping Center**

One KERRIGAN pole does the work of three at the new Summer Avenue Shopping Center in Memphis' big Berclair district. The advanced design of the standards takes full advantage of the most modern methods of shedding more light over wider ground areas-lets 8 poles light a spacious 1000-car parking area.

The 60-foot poles, Weldforged of high strength, lowalloy steel, are octagon shaped, continuous tapered, and fabricated in two sections for telescopic field connection. They are equipped with "wagon wheel" arrangements of luminaires (10 atop six of the poles, and 6 atop the other two).

The \$2,500,000.00 Summer Avenue Center was designed by Thomas F. Faires and Associates and built by Allen Brothers Construction Company. S. & W. Electric Company made the lighting installation; and William B. Thompson was Consulting Engineer for the job . . . all of Memphis.

Kerrigan Lighting Standards are now found all over America-on streets, highways, bridges, and in parks, shopping centers, and stadiums-wherever there is need for modern lighting that will weather the elements and the years. Let us furnish you with more specific information.

Write now for LIGHTING CATALOG No. E-57-6.



FOR BETTER LIGHTED STREETS, HIGHWAYS, AND SHOPPING CENTERS THE STANDARD IS

KERRIGAN IRON WORKS, INC., NASHVILLE, TENNIESSEE . GENERAL SALES OFFICE 274 MADISON AVE.

speaking of air conditioners

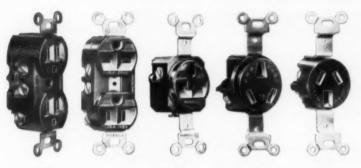
WHATEVER THE CAP...

HUBBELL HAS THE RIGHT CONNECTIONS

When installing an air conditioner, you don't always know in advance what type of cap the manufacturer has used on the equipment. Maybe it's a crowfoot straight blade, a Ushaped parallel blade, a U-shaped tandem ... who knows? ... least of all you, until you see the actual equipment and find out what wiring is required.

Be prepared . . . eliminate that extra trip!

Rather than get caught short without the right receptacles, or for that matter caps, take along Hubbell units shown below, one of which will be sure to answer your need. Hubbell has a complete line of grounding-type caps, connector bodies, receptacles and motor bases to fit every air conditioning need.



Cat. No.

5661

Cat. No. 5262

Duplex Receptacle 15 amp. 125 volt

5292

HARVEY

HUBBELL,

Duplex Receptacle 15 amp. 125 voit and

15 amp. 250 voit

Cat. No.

Combination

Single Receptacle 15 amp. 250 volt

5261 not shown 15 amp. 250 voll

Cat. No.

6810

Single Receptacle

20 amp. 250 volt

WAREHOUSE LOCATIONS ASSURE NATIONWIDE

Cat. No. 6051

Single Receptacle

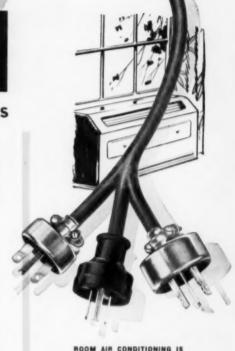
10 amp. 250 volt

WIRING DEVICES . MACHINE SCREWS Dept. C-I BRIDGEPORT 2, CONNECTICUT

HIGHEST QUALITY

WIRING DEVICE STOCK AVAILABILITY

Bridgeport 2, Connecticut icago 7, Illinois Los Angeles 12, Californi San Francisco, Californi Mas 7, Texas



BIG BUSINESS

It is anticipated that 1,750,000 room air conditioners will be installed in 1957. Are you equip-ped to install them? For the necessary wiring devices, see your nearest Hubbell distributor.

CONFIGURATIONS YOU SHOULD KNOW FOR ROOM AIR CONDITIONERS



U-shaped grounding blade with paral-lel slots. For installations up to and in-cluding 15 amp.-125 v.



For 10 to 15 amps, at 220 to 250 volts tandem blade with U-shaped or round grounding blade, or 10 amp, crowfoot pattern may be used.



20 amp, crowlost pattern for 15 to 20 amps, at 220 to 250 volts,



For 3-wire air conditioning units draw-ing more than 20 amps, and less than 30 amps,

For cable ways in exposed locations

OUTDOORS in extremes of weather and temperature—J-M Transite Ducts stay corrosion- and rot-free without paint or surface treatment of any kind.

J-M Transite® Ducts give long, trouble-free service ... never rust, rot, or corrode

Wherever you see conduit—in exposed locations indoors or out—you see more and more of the conduit that really protects—Johns-Manville Asbestos-Cement Transite Ducts.

To cut circuit losses, Transite provides complete circuit isolation with a non-conductive, non-inductive barrier of asbestos and cement. Because it is made of incombustible, completely inert materials, Transite protects adjacent cable runs from the flame and heat of burnouts even at extreme temperatures.

To eliminate raceway maintenance, Johns-Manville Transite Ducts offer you a raceway that is built to take exposure to weather and corrosive atmospheres. No need to paint and repaint—because Transite resists corrosion, fungus, and rot—resists the heat and flame of extreme-temperature burnouts.

Let us send you free brochure EL-29A. Write Johns-Manville, Box 14, New York 16, New York. In Canada: Port Credit, Ontario.



INDOORS — Transite's light weight, quickly assembled tapered couplings, and pre-shaped bends offer installation speed to match Transite's low maintenance requirements.

Johns-Manville TRANSITE DUCTS

Made of Asbestos-Cement

J-M Conduit for exposed and underground installations without concrete

J-M Korduct® for installation in concrete

RECEPTACLES CAPS 17 PARALLEL SLOT SINGLE A FULL PARALLEL BLADE ARMORED RECEPTACLE 3 WIRE GROUNDING 3-WIRE CAP Heavy Bakelite-"U" Shaped Wide Ears Double Contacts Blade for Grounding Cord Hole Diameter .187—.625 15 Amp.-125 Volts 2524 OF TANDEM SLOT SINGLE TANDEM BLADE ARMORED RECEPTACIE ... 3-WIRE CAP 3 WIRE GROUNDING Heavy Bakelite-"U" Shaped Wide Ears Blade for Grounding Cord Hole Diameter .187—.625 QUALITY **Double Contacts** 15 Amp.-250 Volts GROUNDING 2517B PARALLEL SLOT DUPLEX PARALLEL BLADE RECEPTACLE 3-WIRE CAP 3 WIRE GROUNDING Heavy Bakelite-"U" Shaped DEVICES Wide Ears-Double Contacts Blade for Grounding Cord Hole Diameter .437 15 Amp.-125 Volts 2527B TANDEM SLOT DUPLEX TANDEM BLADE RECEPTACLE 3-WIRE CAP 3 WIRE GROUNDING Heavy Bakelite-"U" Shaped Blade for Grounding Cord Hole Diameter .437 Wide Ears—Double Contacts 15 Amp.-250 Volts All Items Available in Ivory - And All Receptacles Available on Box Covers ADAPTER 2573-L Portable tools or appliances 3-WIRE BAKELITE equipped with new type GROUNDING ADAPTER "grounding caps" may be Polarized Slots and quickly adapted to regular "U" Shaped Grounding Slot 2-wire outlets with this 3" Green Thermoplastic new adapter. GROUNDING Grounding Lead. 15 Amp.-125 Volts 3631 FOR DRYER AND POWER DEVICES CORDS. 30 AMP. DRYER AND POWER RECEPTACLE Flush or Surface Mount Polarized with "L" Shaped WITH A **Grounding Slot** 30 Amp .- 250 Volts TERRIFIC FOR RANGE AND POWER CORDS, RANGE AND "QSP" POWER RECEPTACLE Flush or Surface Mount **Heavy Bakelite** with Patented Swing-Away RATING Terminals—Polarized 50 Amp.-250 Volts QUALITY tops 30 AMP. 3-WIRE DRYER AND POWER CORD SET SERVICE One Piece Molded Rubber outstanding Cap-Includes Cable Clamp 30 Amp.-250 Volts PRICE lowest

CIRCLE F MFG., CO., TRENTON 4, NEW JERSEY

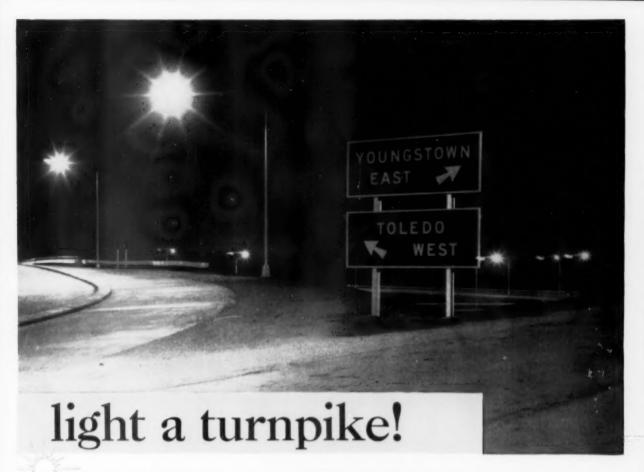




HERE'S the way to



52



The new Ohio Turnpike, spanning the state from Pennsylvania to Indiana, is a model of modern highway construction. And one of the outstanding features of this road is the lighting of the interchanges.

What an immense job it was to build this 241-mile road! Enough dirt was excavated to fill a two-lane tunnel 268 miles long. They dumped enough fill to cover 500 football fields to a depth of 28 feet. Carefully the bogs were drained, slides were stopped and the rock was blasted to make the great road possible.

Skillful engineering is apparent along every foot of the Turnpike—and this includes the selection of vital materials used to build it. Buried in the ground near the interchanges you'll find over half a million feet of Tiger Brand 3,000-volt

internal shielded cable serving as main feeders. Many thousands of feet of Tiger Brand RR cable serve as bracket cable in the poles, and an additional quarter million feet of Tiger Brand cable grounds the entire system.

When you install Tiger Brand cable, you have gone a long way toward insuring a trouble-free wiring system.

AMERICAN STEEL & WIRE DIVISION, UNITED STATES STEEL, GENERAL OFFICES: CLEVELAND, OHIO

COLUMBIA GENEVA STEEL DIVISION, SAN FRANCISCO, PACIFIC COAST DISTRIBUTORS . TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA., SOUTHERN DISTRIBUTORS UNITED STATES STEEL EXPORT COMPANY, NEW YORK

USS TIGER BRAND ELECTRICAL WIRE & CABLE



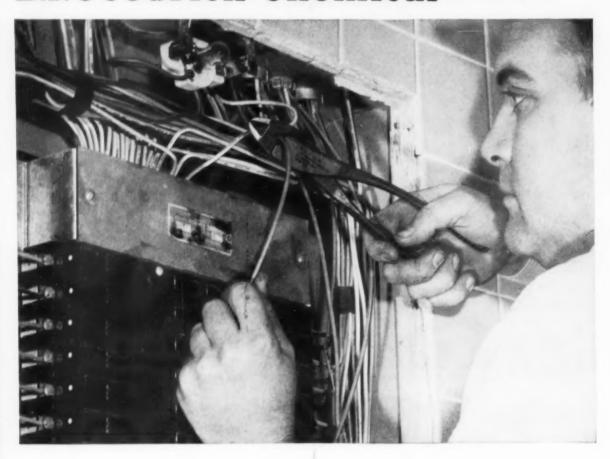
A STANDARD TIGER BRAND CABLE FOR EVERY SPECIAL JOB

- asbestos wire and cable
- mold cured portable cord
- shovel & dredge cable
- paper & lead cable
- varnished cambric cable
- · interlocked armor cable
- special purpose wire & cable
- · aerial, underground and submarine cable



UNITED STATES STEEL

B.F.Goodrich Chemical raw materials



For a lifetime of adequate wiring . . . insulation of Geon

BUILDING wire insulated with Geon polyvinyl materials is playing a prominent role in today's adequate wiring movement for homes and buildings. And for good reason.

These materials have exceptional properties that give TW building wire many desirable features: smaller overall wire diameters are possible because of improved insulating ability; permanent fire resistance; resistance to acids, oils, alkalies, dampness, fungi and voltage

breakdowns. Since Geon polyvinyl materials have exceptional aging characteristics, insulation maintains strength and flexibility.

Owners like the safety and dependable service these "Geoninsulated" wires provide through the years. Contractors: prefer them for their good flex, clean stripping qualities, toughness, abrasion resistance and the ease with which they pull through studs, joists and conduits.

For information write Dept. GF-3, B.F.Goodrich Chemical Company,

3135 Euclid Avenue, Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ontario.



B.F. Goodrich Chemical Company a division of The B.F. Goodrich Company



RFGoodrich GEON polyvinyl materials - HYCAR American rubber and latex - GOOD-RITE chemicals and plasticizers - HARMON colors

Troffers of ALL Types by



MAXIMUM CEILING ADAPTABILITY

1'x4' Rectangles 1'x8' Rectangles 3' Circles 6' Circles 2'x4' Rectangles 2'x2' Squares 4'x4' Squares

Continuous Rows

Widest possible range of shapes and forms . . . making possible unlimited patterns and combinations.

Widest possible choice of diffusers . . . polystyrene louvers . . . plain formed acrylic . . . corning low brightness . . . curved corning lens . . . curved alba-lite . . . corning twinlens . . . flat alba-lite . . . metal louver ... pattern formed acrylic ... pattern formed vinyl.

Space variations . . . 21/4" "Thin," where ceiling economy is critical . . . 41/4" "Shallow," when limited space is available . . . 73/4" deep, when normal recessing depth is possible.

Workmanship . . . highest possible quality material. formed and assembled under unmatched inspection standards by top skilled craftsmen.

Sensible pricing . . . if quality luminaires could be produced and sold for less, LPI would be the one to do it.

MAIL THIS COUPON TODAY

Don't just take our word for it! Convince yourself that LPI has the widest, most complete line of TROFFERS.

There is an LPI TROFFER-combination to solve any problem concerned with esthetics, space, light control and distribution, construction quality or sensible price.

LIGHTING PRODUCTS INC. Dept. 4F Highland Park, Illinois

Please send detailed information on LPI's complete line of Traffers.

Firm

Address

73/8"





Provides 4" expansion, contraction movement, Malleable iron head, body Hot Dip Galvanized. Weathertight head sealed by factory-installed high grade graphite packing. Insulating conduit end bushing eliminates cable abrasion. 10 sizes for conduit 1/2" to 4" diameters.

Type EX



Permits 8" conduit movement. Optional length sleeves, vermirs a conduit movement. Uptional length sieeves, additional cost. Weathertight head sealed by factory. adantonal cost. Weathertight head sealed by factory-installed high grade graphite packing. Insulating bushings prevent cable abrasion. Hot Dip Galvanized nings prevent cable abrasion. Not Dip Galvanized finish. 13 sizes for 1/2" to 6" conduit diameters.

Compensates for deflection, expansion, contraction. Compensates for detrection, expansion, contraction, 34" movement all directions from normal, 30° angular movement. Also used as vibration damper between conduit sections. 10 sizes.

Type EXE



vreatheright end type expan-sion fitting. Designed for conduit terminating in junction box, where expansion, contrac-tion take place. Supplied complete: locknuts, bushings. Weathertight and type expan-Standard finish, Hot Dip Galvanized, 13 sizes.



Similar to the Type AX, this unit is supplied complete Similar to the Type AX, this unit is supplied complete with well with extension nipplies, ready to receive thin well with extension nipplies, is cadmium plated. Available extension nipplies, is cadmium plated. Yet a 2'-cauplings. Standard finish is renaine from 1/3" to 2'-cauplings. Standard finish is renaine from 1/3" to 2'-cauplings. couplings. Standard finish is codmium plated. Available in 6 sixes for conduit ranging from 1/2" to 3". for the longer line of **EXPANSION** FITTING

In the long run, no line of conduit is more dependable than its components. When it comes to dependability in expansion fittings, look to O. Z. as the line that measures up! Five basic types

provide the dependable answer to your fitting problems in conduit expansion, contraction, and deflection. O. Z. is the dependable line because it's the line with the right size, the right type, for every requirement!



- CAST IRON BOXES
 CABLE TERMINATORS
 POWER CONNECTORS
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ELECTRICAL MANUFACTURING CO., INC.

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Pennsylvania's
Turnpike...
Model for
Modern Motoring



WIRE BY PHELPS DODGE

When the Pennsylvania Turnpike opened in 1940, it was the first modern highway of its kind in the East. Since then, it has earned a reputation as a model super-highway whose design combines a free flow of traffic with a low accident rate.

One of the requirements for the Turnpike tunnels, interchanges, approaches and portal buildings was an electrical system of the highest quality. That's why Phelps Dodge building wire and rubber insulated, neoprene-jacketed cable was installed. For 17 years, this wire and cable has been giving the Turnpike dependable, trouble-free service.

On every wiring job where top-quality performance, expert workmanship and experienced "know-how" are called for, it pays to rely on Phelps Dodge and your Phelps Dodge distributor!



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LOW VOLTAGE SWITCHGEAR

SAFEST

No live parts exposed even in test position





Consider the additional protection offered by unexposed live parts even in test position and you will understand why I-T-E Low Voltage Switchgear is the safest of them all. And there are many other reasons why this is so. Here are some of them:

Test Position with Doors Closed. I-T-E's exclusive extendible escutcheon method establishes a new standard of safety and convenience in testing circuit breakers.

Reduced Handling. Circuit breakers can be stored in their respective compartments, de-energized, with doors closed.

Dust and Dirt Protection. The flat dust-seal frame which surrounds the escutcheon keeps the circuit breakers free of dirt and dust.

Extended Escutcheon tells at a glance when the circuit breaker is in the disengaged or test position.

Interlocked. A mechanical interlock prevents the circuit breaker from being moved from or into the engaged position unless the primary contacts are open.

No Open Doors to create safety hazards or mar the modern, attractive appearance of the switchgear when the circuits are de-energized.

For complete information about the safest switchgear of them all, contact the nearest I-T-E District Sales Office, or send for a copy of Bulletin 6004B. I-T-E Circuit Breaker Company, 19th & Hamilton Sts., Philadelphia 30, Pa.

I-T-E CIRCUIT BREAKER COMPANY · Switchgear Division

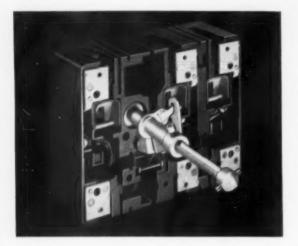
IN CANADA: EASTERN POWER DEVICES LTD.

No Live Parts Expessed even in test position. The exclusive I-T-E extendible escutcheon method establishes a new standard of safety and convenience in

testing circuit breakers.







ANOTHER ADVANCED DESIGN FROM WESTINGHOUSE

This compact new type of panel switch features . . .

- Visible contacts
- Fused or unfused operation
- Choice of Vari-depth or toggle handle
- · Standard cover drilling
- · Fast mounting
- · Low cost

Quick-make, quick-break action plus De-ion arc-quenching grids assures positive switching, long operating life. Ready visibility of the blades means extra safety.

The Vari-depth operator, featuring a threaded telescoping shaft, makes it easy to fit panels of various depths . . . without mounting stilts. It also simplifies cover drilling.

Fuse kits permit mounting several sizes of fuse clips on the switch. As a fused switch, Visi-Flex saves space and the cost of separate fuse blocks.

For use as a disconnect switch, a safety shield without fuse clips is available. You just order the basic switch and the required kit . . . all hardware is included.

Low in cost, flexible, simple to install, Visi-Flex requires a mininum of space. Visi-Flex switches come in 30- and 60-ampere ratings. 100- to 200-ampere models available later.

For additional information write to Westinghouse Electric Corporation, Box 868, Pittsburgh 30, Pa., for Booklet SM-5457.

YOU CAN BE SURE ... IF IT'S

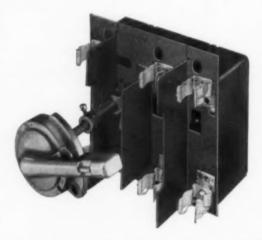


Westinghouse

Westinghouse **VISI-FLEX** De-ion Switch fits any panel

ANOTHER ADVANCED DESIGN FROM WESTINGHOUSE .

Model A has adjustable Vari-depth handle mechanismshown with fuse kit assembled. Also available with safety shield for no-fuze operation,



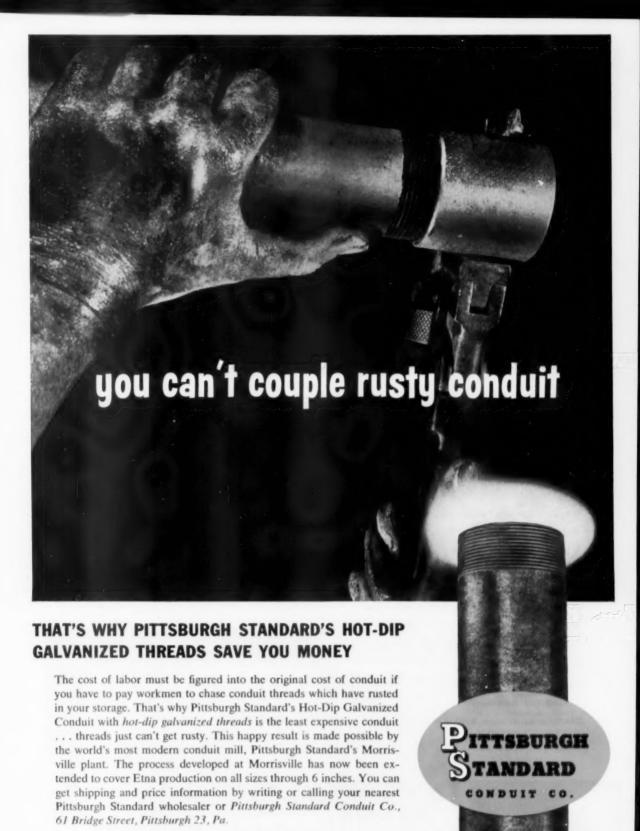
Model T has toggle handle for slide plate or cam-type mechanism-shown with a safety shield for no-fuze operation. Also available with several sizes of fuse clips,



ANOTHER ADVANCED DESIGN FROM WESTINGHOUSE . ANOTHER ADVANCED DESIGN FROM WESTINGHOUSE .

ANOTHER

ADVANCED



PLANTS AT MORRISVILLE & ETNA, PA.

RIGID STEEL CONDUIT . ELECTRICAL METALLIC TUBING . ELBOWS . COUPLINGS . FITTINGS

Here's a fixture that's really needed, that's priced right, that **SELLS!**



THE Guardian Verti-Flood

Here's a fixture engineered to do a particular job better than it's ever been done before-to light a vertical surface evenly, from top to bottom, with no hot spots, no shadows, with no color distortion. Guardian Verti-Flood is the perfect fixture for all types of vertical sign lighting, from 24 sheet to posters-for store front lighting. for building front lighting. A low cost fixture, for either Rapid Start or Power Groove lamps that sells itself on a straight cost versus efficiency basis. Write for literature, prices and discounts.







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low voltage
switchgear

"Out in Front".

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"Out in Front" with the contoured door panel that provides exclusive breaker storage inside cubicle.

In every way, this is outstanding switchgear. Whether it's the sleek-looking, two-tone outdoor gear with the inner service aisle . . . or the neat, compact indoor gear, you get the latest in features, design and construction.

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tion to provide additional space in the closed cubicle when breaker is in test or disconnected position.

Panel is shown in its reversed or protruding posi-

Safety first! Positive mechanical trip interlock automatically trips the breaker if anyone tries to move it in or out of the operating position while breaker is closed. Note also that breaker operation can be checked in test position with door closed or open.



Extra convenience.

Movable primary and secondary disconnects are easily inspected through large cut-out on each side of breaker mounting frame. It's not necessary to remove breaker from mounting for this inspection.



ALLIS-CHALMERS

ELECTRICAL CONSTRUCTION AND MAINTENANCE . . . JUNE, 1957



In many installations — particularly in hospitals, libraries, schools, churches, private offices and homes — noise is a *critical* factor. Ballast hum increases in proportion to the number of fixtures in a room. So, the greater the number of fixtures, the more urgent the need for ballasts with the *best* acoustical rating available.

There are six important reasons why Jefferson Ballasts are quieter, from an integral core structure which cannot vibrate within itself, to the complete performance tests prior to shipment. Use the sound control chart in the booklet offered here to select the proper Jefferson Ballasts for each room's characteristics. There you'll have satisfactory installations — and satisfied, happy customers.

Where sound control is important Use Jefferson Rated Ballasts



WRITE NOW ... FOR THIS SOUND CONTROL BOOKLET

Sound control charts and room characteristic information help you plan properly to eliminate complaints. No charge to the electrical trade. Just send name and address for your copy.

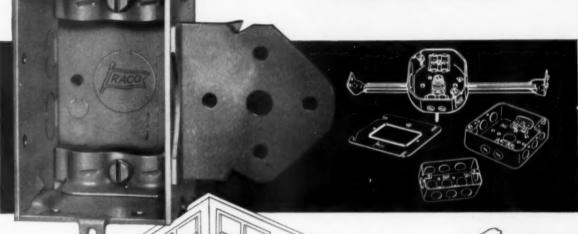


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SWITCH BOXES
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A COMPLETE LINE OF ELECTRICAL BOXES

You can readily recognize the high quality of RACO products... beautifully finished ... smooth edges ... deep, clean-cut threads. Made of heavy gauge steel ... engineered to exceed local and national code requirements. On new jobs... on rewiring you can always rely on RACO. Write for complete information.



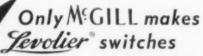
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"A RACO BOX FOR EVERY NEED"

ALL-STEEL EQUIPMENT INC. Aurora, Illinois

SPECIFY QUALITY ...

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— and only Levolier switches give you the degree of quality that has earned them the reputation of being the most dependable switches ever built. Material selected for extra quality includes heavy special alloy copper or silver for contacts and all switches are pre-lubricated with highly refined plastic petroleum. Completed switches are 100% factory tested and eliminate costly replacement. Levolier switches are designed for fast, economical installation with self-insulating molded phenolic cases. .75 to 20 amps. All are Underwriters Laboratories Inspected.

No. 71 single pole single circuit, universal pull lever switch . . . the thinnest 6 amp. "T" 125 volt—3 amp. 250 volt switch of its kind on the market today—only 15/32" thick. Also with push button.

No. 1010 single-pole, single circuit lever switch for highwatt lamps and fluorescent banks. Universal pull lever control. 10 amp. 125 volt.

No. 25 toggle switch carries a 6 amp. "T", 125 volt, 3 amp., 250 volt rating with a S. P. S. T. double-break mechanism. 1/3 H.P. A.C. 120-240 volt. Ideal for panel board, F.H.P.

volt. Ideal for panel board, F.H.P. motors, appliances, power tools, etc. Also with push button control.

No. 90 ¾ H.P. capacity, 15 amp. 125 volt, 10 amp. 250 volt toggle switch with a single pole, single-throw mechanism. Designed for AC operation. Also available in two circuit with center off and no off.

No. 41 single-pole, single-circuit, universal lever switch. 6 amp. "T", 125 volt—3 amp. 250 volt. Only 3/8" thick, it is ideal for conduit box and canopy mounting for lighting and for FHP motor control.

No. 29 single-circuit, .75 amp., 125 volt momentary contact switch. Excellent for automatic control of lights as in door openings and closings. Also 4 amp. Available 15 amp., for limit and safety control of industrial machinery operations.

FREE! For complete details on McGill switches, sockets, lampguards and other electrical specialties, write for catalog #84.

Available from your electrical wholesaler.

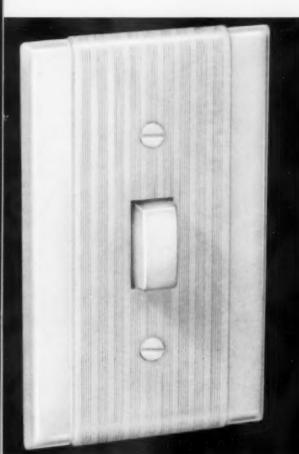
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· · newest member of the famous Quiette Switch Family!





ARROW AH HART Juiette TAP ACTION SWITCH

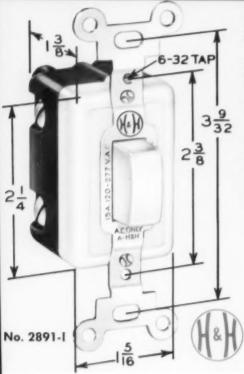
The newest, smartest touch in lighting control!

The gentlest pressure on any area of the button and it's on . . . instantly . . . quietly. Another gentle touch . . . it's off. No longer any need to flip a toggle or twist a knob . .. here's the easiest, quietest light control within reach . . . of finger-tip, hand or elbow.

- FITS ANY STANDARD TOGGLE WALL PLATE
- Rating: Specification Grade, 15 and 20 Amps.
- * Binding Screw or Screwless terminals
- . For all standard connections, Brown or Ivery
- . Operates on full voltage, non-relay
- · Quiet, safe mechanical operation

See reverse side for more information

The New ARROW AHHART LIETTE STAP ACTION SWITCH for quiet, convenience AND quality



Here's the light switch of today and tomorrow . . . available TODAY.

Careful selection of materials insures a lifetime of quiet luxury. Large silver alloy contacts provide greater electrical efficiency. Your choice of conventional Binding Screws, or Screwless Terminals which lock the wires securely in the switch.

With the New QUIETTE TAP-ACTION Switch, the quiet, safe operation of Incandescent and Fluorescent lights and appliances is completely dependable. The gentlest touch of fingertip, hand or elbow on any portion of the button is all that's required.



FITS ANY STANDARD TOGGLE WALL PLATE

SPECIFICATION GRADE





15 Amperes, 120-277 Volts A.C. Only

CATALOG NUMBERS

Binding Screws	Screwless	DESCRIPTION
2891	2891-SL	Single Pole
2892	2892-SL	Double Pole
2893	2893-SL	Three-Way
2894	2894-SL	Four-Way
2074	2071-30	1001-1101

Add: "I" for Ivorylite

20 Amperes, 120-277 Volts A.C. Only

CATALOG NUMBERS

Binding Screws	Screwless	DESCRIPTION
2991	2991-SL	Single Pole
2992	2992-SL	Double Pole
2993	2993-SL	Three-Way
2994	2994-SL	Four-Way

Add: "I" for Ivorylite



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Please send my copy of "The NEW QUIETTE TAP-ACTION Switch" folder (Form A-226).

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Sorgel dry-type transformers Sorgel dry-type two largest buildings erected in New York City since the war



SOCONY MOBIL BUILDING, the largest air-conditioned office building in the world.

Architects: Harrison & Abramovitz, Associate Architect: John B. Peterkin, Electrical Engineer: Edward E. Ashley, Electrical Contractors: Fischbach & Moore, Inc.

Higher Voltage Distribution

Higher voltage distribution, with SORGEL dry-type transformers at load centers, which we have been advocating for years, is now recognized as the most efficient and economical method of interior electrical distribution. It has been adopted for the Socony Mobil Building and the new Coliseum in New York City.



NEW YORK COLISEUM, the largest exhibition building of its kind in the world.

Architects: Leon and Lionel Levy, with Aymar Embury II,
Otto Eggers of Eggers & Higgins, and John B.
Peterkin, as a consulting and advisory committee.
Engineer: Guy B. Panero.
Electrical Contractors: Jackson-Livingston.

Most Quiet Operation Demanded

The engineers' principal requirement was that the transformers have a low sound level. Regular tests, made in our laboratory, prove that the sound level of SORGEL dry-type transformers is well below the established standards. Because of their unusually quiet operation, SORGEL transformers are particularly adaptable for any indoor installations.

Liberal Design for Full Rated Load

SORGEL dry-type transformers are guaranteed to carry the full load continuously at a safe operating temperature. They are so liberally designed that they can safely carry an overload during an emergency.



Tested and approved by Underwriters' Laboratories under the Re-examination Service

SORGEL ELECTRIC CO., 836 West National Ave., Milwaukee 4, Wisconsin





Red Throat Insulated Connector



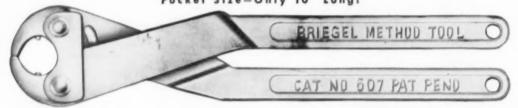






Rod Throat Cross section

THE NEW BM607 INDENTER FOR 1/2" FITTINGS Pocket Size-Only 10" Long!



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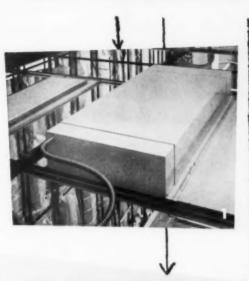
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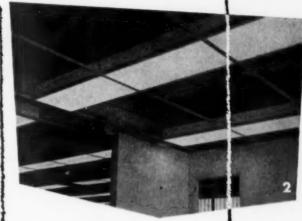


All B-M Indenter Fittings are U.L. Approved as concrete-tight and all Compression Fittings as raintight as well as for general use (File Card E10863). Also comply With Federal Specifications W-F-406.



GALVA, . ILLINOIS

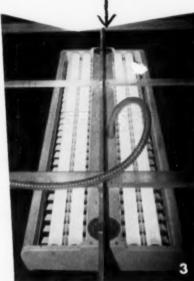


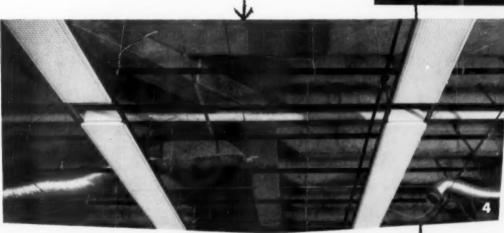


MORE SUNBEAM LIGHTING GOES UP AS CEILING HEIGHTS COME DOWN

In keeping with the modern trend toward lower and more functional ceiling arrangements, Sunbeam Lighting Visionaires® prove their adaptability and flexibility daily. New ceiling construction methods are kept under constant study by our engineers so that maximum versatility and simplicity of installation are designed into every fixture. Our recessed, "large area" 3600 series, for instance (photos 1 and 2), are as easily installed or relocated within suspended ceiling systems as the acoustical panels themselves. Other units, such as the standard 5600 series troffers, are adaptable to a wide range of installation requirements including suspended, "snap-in" T-bar mounting (photo 4).

Our newly developed CSM7 hanger for "surface mounting" of luminaires directly onto suspended ceiling runners eliminates the need for separate and costly hanging systems (photo 3). Every effort is made to construct Sunbeam Visionaires® so that they may be installed and maintained with minimum use of tools.





Remember, for the ultimate in shallow, surface-mounted fixtures, it's the SHALLORAMA!



SUNBEAM LIGHTING COMPANY



Now Westinghouse announces complete control center flexibility

New design meets changing requirements with both 14- and 9½-inch modular units

From the new 9½-inch units to the dependable electrical components, the new Westinghouse control center is designed to meet your present requirements and future needs. Both the 14-inch and 9½-inch units can be quickly interchanged within a standard structure.

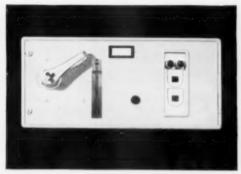
Fully interchangeable with the old design, this new control center is available for front mounting or back-to-back mounting... in same structure with common vertical bus. Everything about this new Westinghouse unit says good design, safety, and versatility. And you have the advantage of dealing with one source to supply all components. Call your Westinghouse sales engineer for all the facts. Or, write Westinghouse Electric Corporation, 3 Gateway Center, P. O. Box 868, Pittsburgh 30, Pennsylvania. Ask for B-6722. J-21941

Westinghouse





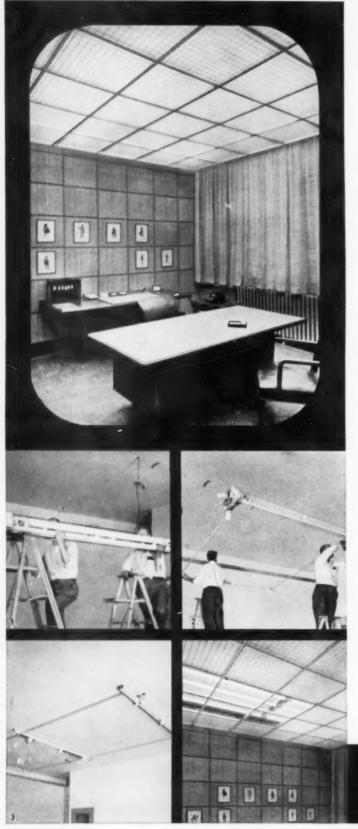
Slight Movement of Retaining Clips ...and horizontal starter unit support bar can be moved to any position for interchangeability of 91%- or 14-inch Westinghouse modular units.



Door Cutout makes it unnecessary to change door when changing pilot device arrangement. Quick-make, quick-break, positive-action, modern pushbuttons in strong molded case take up less space.



Here is Complete Flexibility... of structural units and electrical components. Each vertical structure holds from one to eight, front only, or up to 16 back-to-back units, to meet all needs.



New Curtis strato-lux luminaire features curticell louver-diffuser and economical installation

 Strato-Lux, a free-floating large area luminaire, provides evenly distributed, glare-free illumination with the exclusive new CurtiCell louver-diffuser of vinyl plastic.

CurtiCell is the only diffusing element to provide both light diffusion and shielding of the diffusing medium through the unique combination of a flat and a formed sheet of cellular design. An interesting textured ceiling results, without the monotonous appearance common to ordinary diffusing media.

Ask your Curtis representative for his professional assistance in applying the Strato-Lux principle to your lighting requirements.

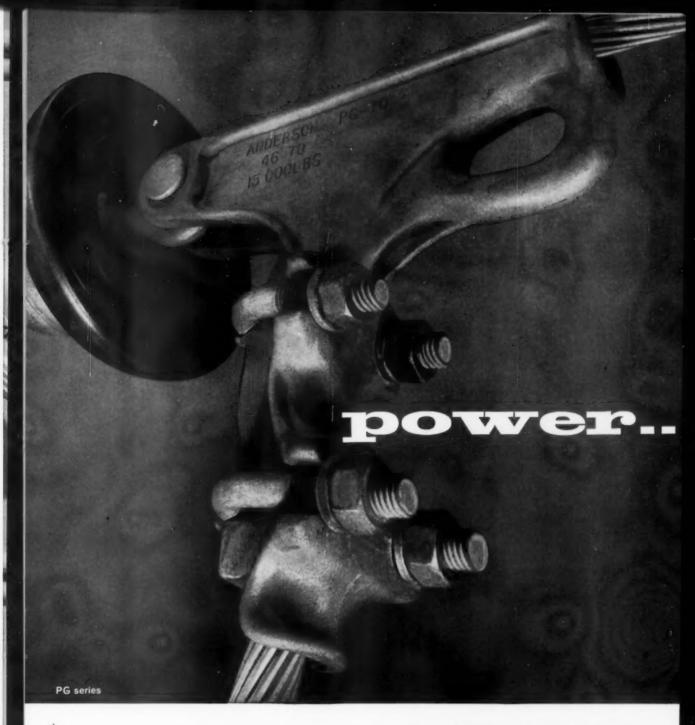
- Clamp hangers are mounted to ceilings or stems.
 Pre-wired grid is lifted to ceiling, inner packing intact.
- Large channel is suspended from clamps. The small channels are moved outward, spaced by locked-in tubing, and suspended from clamps.
- 3. Additional grids are installed as required.
- Spoke hangers are mounted to grid. Inverted "T" framework, is attached, lamps and CurtiCell panels are installed.

CURTIS LIGHTING, INCORPORATED 6135 W. 65th St., Chicago 38, Illinois

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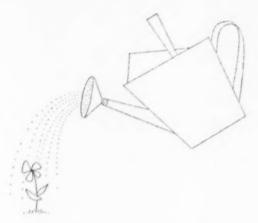
Anderson's Pistol Grip aluminum dead end clamps give top performance on distribution and sub-transmission systems. Snub Seat design assures high holding power. Strong, lightweight aluminum construction reduces cable damage, and one-piece keeper assembly speeds installation.

ANDERSON ELECTRIC CORPORATION Birmingham 1, Alabama.

Export Representative: International Standard Electric Corp.

Aluminum & Bronze Power Connectors • Clamps • Fittings • Accessories for SUBSTATION • TRANSMISSION • DISTRIBUTION

want more new construction business, this advertisement will be of service to you—because...



We help make your business grow

Unless you know what's going to be built, trying to get business in the new construction field is like planting seeds at random — you can't be sure what, if anything, is going to come up, where or when. Dodge Reports won't make your flowers sprout, but these timely, accurate, daily reports will help make your business grow. How? Read and mail the coupon in, and we'll tell you.

TO: DODGE REPORTS, DEPT. 94, 119 WEST 40th STREET, NEW YORK 18, N. Y.

Yes! I'd like to pin-point my prospects by knowing in advance who's going to build, what, when, where.

I want to know whom to contact and when to submit bids.

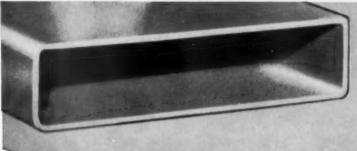
I'd like to see some Dodge Reports, and I'd like a copy of your booklet that tells how to use this accurate, daily, up-to-the-minute construction news service.

I understand that I can pick just the area in the 37 Eastern States and the type of construction activity that interests me. Also, that I won't have to wade through mounds of data to find the information I need.

I'm interested in General Building House Construction	☐ Engineering (Heavy Construction) ☐
in the Following Area:	
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WALKER HEADERDUCT...

saves contractor's time and owner's money



LARGEST

Walker Headerduct has a cross-sectional area of 8.75 sq. in. — the largest wiring capacity of any headerduct on the market. This means easier wiring for today's needs and more room for future expansion.

FAST, EASY LEVELING OF ACCESS UNITS

Access unit ring can be raised and leveled with the floor — even after concrete has set — without removing the cover plate. Positive 3-screw leveling affords up to \(\frac{5}{6} \) " adjustment.



LESS THAN A MINUTE TO BUSH HEADER-TO-CELL

Steel snap ring rolls in place quickly and easily, provides smooth bushing and secure fastening. No complicated tooling required.



Walker of Conshohocken

A MAJOR TIME SAVER— THE WALKER AFTERSET INSERT

A Walker one-piece afterset insert is placed in the cell opening and is crimped firmly in place in a matter of seconds with a drift-pin and hammer. Multiply time saved by one of these inserts times all service outlets and you have a major saving in time and money.

WALKER BROTHERS

Conshohocken 3, Pa.

UNDERFLOOR ELECTRICAL DISTRIBUTION SYSTEMS RIGID STEEL CONDUIT . E.M.T. . WIRE AND CABLE



More profits than anticipated

"On jobs we engineer, we specify Day-Brite wherever possible. It's always a pleasure to have jobs check out with greater results than anticipated and we can only attribute this to the superior design features of Day-Brite lighting," says Oscar Lundberg.

"Day-Brite's ease of installation and time-saving devices add up to more profits for us. And we're assured our clients receive maximum results and performance from a quality product."

You can take it from Mr. Lundberg, Day-Brite is tops for quality, performance, appearance. And no other fixtures on the market are so thoroughly engineered for quick, simple, economical installation. In fact, you'd think they were actually designed by contractors.



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EASY TO INSTALL ...

4-ft. Rapid-Start lamps in 4-ft. and 8-ft. complete units or 8-ft. fill-in sections.

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ULTRA QUALITY . . . Moulded plastic enclosures assure consistency in color, transparency, dimensional

EASY TO SERVICE ...

Enclosure sections mounted in 4-ft. concealed metal frames. Separable hinges and snap latches. No tools needed.

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stability.



A fuse included with each Rapid-Start ballast prevents overheating. All HOLIDAY'S are U-L approved.



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The Amprobe Jr. gives you so much more! And the cost is only \$19.85 (just a few dollars more than an ordinary voltage tester).

Why be half-equipped with just a voltage tester? The Amprobe Jr. meets all your testing needs...measures voltage and current instantly and accurately without shutting down equipment. All this with one rugged and inexpensive pocket-size tester!

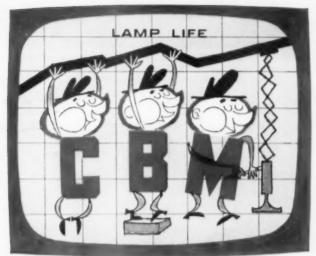
There's an Amprobe Jr. for every job ... five different current models in either 125-250 V. A-C, or 150-600 V. A-C. Have your jobber show you the model that fits your job best.

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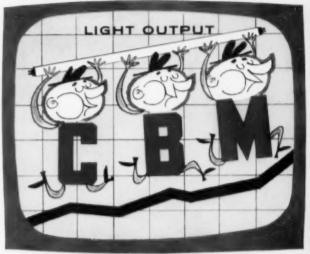
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Does it come in a full line of models to meet different problems?	YES	NO
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motor overloads, check rating of circuit breakers?		
rating of circuit breakers?	AMPROBE)	ACTION ACTION
rating of circuit breakers?	50	ACTUAL

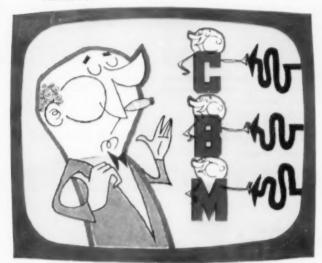
Why CERTIFIED CBM BALLASTS mean fluorescent lighting that really measures up!



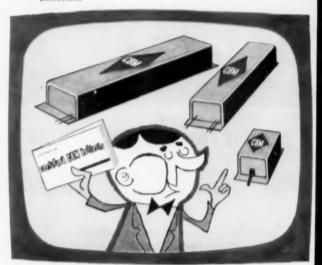
YOU GET PEAK LIGHTING PERFORMANCE with CERTIFIED CBM BALLASTS in fluorescent fixtures. And you assure customer satisfaction just as you planned because . . .



CERTIFIED CBM BALLASTS are built to exacting "specs" to give assured life, optimum light output, and rated lamp life. And they're all UL approved and Power Factor corrected.



THEY PROTECT YOUR CUSTOMERS . . . help you, too. Says one lamp manufacturer, "This certification (CBM) assures without individual testing that lamps will operate at values close to ratings."



"CBM...INEXPENSIVE INSURANCE", says another tube maker. Be sure to specify fixtures equipped with CERTIFIED CBM BALLASTS and write for "Why it pays'..." booklet today!

Not all ballasts are the same . . . Certified CBM ballasts are "tailored to the tube". Insist on CBM ballasts, certified by ETL, in the fixtures you choose.

Seven leading manufacturers now make up



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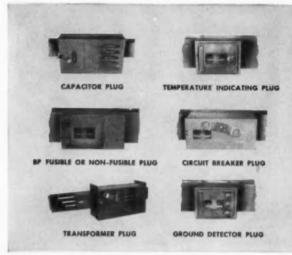
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Participation in CBM is open to any manufacturer who wishes to qualify





The Vacu-Break® Plug (above) taps live power, is available in 30 to 600 amps, 2 or 3 pole, 600 volts or less. Reinforced fingers on all plugs insure positive pressure contact.



All BullDog Bus Plugs mount on either side of the duct easily, quickly . . . eliminate rewiring and downtime. Types available for every purpose.

Seven rugged Bus Plugs provide flexible plug-in power

Get the most from power with BullDog Bus Plugs. Used with Plug-in Duct, the seven bus plugs range from safety-check plugs to types that tap power instantly from the duct... provide safe, flexible electrical distribution.

Plug-in openings are spaced every 10 inches along the duct. Handy to any machine, they reduce long costly branch-circuit runs. You simply plug in circuits where they are needed . . . connect equipment without cutting off power or interrupting production.

Learn how a co-ordinated BullDog distribution system, from bus plugs to unit substations, provides efficiency and flexibility for your clients . . . a wealth of customer satisfaction and profits for you. See your BullDog field engineer for complete details.

ButlDog Electric Products Company, Detroit 32, Michigan. A Division of I-T-E Circuit Breaker Company & Export Division: 13 East 40th St., New York 16, New York. In Canada: ButlDog Electric Products Company (Canada), Ltd., 80 Clayson Rd., Torento 15, Onterio.



IF IT'S NEW ... IF IT'S DIFFERENT ... IF IT'S BETTER ... IT'S

BULLDOG

ELECTRIC PRODUCTS COMPANY

A DIVISION OF 1-T-E CIRCUIT BREAKER COMPANY

Changing Profile

The changing business profile of electrical contracting activity is reflected in a notable broadening of objectives among individual firms. The forward look is trending away from narrow specialization toward organizations capable of profitable operation in several types of services.

The trend is not conspicuous. You have to look for it. Pick out two or three firms in your own area-good, smart, going concerns-and watch what they are doing. Chances are you will find that they are quietly broadening their market objectives and building alert, flexible, sales-conscious organizations.

There's no mystery in the motives. Big-figure, new building projects, rolling in abundance out of architect's offices, are easy to find and easy to take-at a low margin. Across the street from the new brick pile, however, are maybe ten buildings in desperate need of electrical modernization. This market takes selling, timeconsuming organized staff work, ingenious problem-solving; but profit potential is excellent.

Down Main Street and out through the industrial suburbs are customers who want fast, responsible service. This market takes sales-wise and service-oriented organizations, but it is solid bread-and-butter income on the monthly statement.

Individual company strategy toward broader market opportunities varies but there are some fairly distinct common denominators;

· Permissive management. Operating responsibility, authority and decisionmaking are delegated into the line. The front office is sales-minded, flexible, guiding, problem-solving, and free of routine.

· Departmental organization. Each class of work flows through its own specific

efficient procedure.

· Active public relations. The firm employs sound, skillfully-planned sales promotion and advertising and maintains confident relations with the press and other communication media.

These are encouraging signs. The electrical contractor has enjoyed many prosperous years and such times tend to solidify the successful formula and the convenient specialty. But this is a growing, expanding industry with plenty of room for initiative and aggressive market exploration. And the established firm has the best opportunity.

To adapt fully to the changing market profile and to provide already needed services are going to take more than a trend. But the broad management study and analysis the trends will inspire, will also direct some top-flight thinking to organization building, marketing objectives and, we hope, to the long range future of the industry.

Um. T. Stuart



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AERIAL VIEW from Port Authority helicopter shows (1) New Jersey portal to \$100-million Third Tube, (2) 18 new driver-side toll booths beneath continuous canopy, (3) new administration and control building, (4) helical 6-lane approach, (5) ventilation buildings on Jersey side, and (6) elevated connection with all principal North Jersey highways. For orientation purposes, note relative location of (7) George Washington Bridge and (8) Manhatton Island.

Features of Tunnel Electrification

Lincoln Tunnel's \$8-million electrical contract included installation of 6 sources for primary power, automatic transfers, multi-level fluorescent lighting, positive ventilation, comprehensive traffic control system and scores of safety provisions. Electrical installation was completed primarily by contractors Fischbach and Moore, Lightning Electric Service, Jandous Electrical Construction and Plymouth Electric Construction.

By James F. Meyers
Assistant to the Chief Engineer, The Port of New York Authority

URING the past month, the Third Tube of the Lincoln Tunnel opened for traffic, thereby expanding this trans-Hudson subaqueous vehicular artery to six lanes, doubling the tunnel's rush-hour capacity and boosting the annual overall capacity by at least 50%. These statistics are impressive ones, for traffic through the tunnel last year exceeded 21 million vehicles. Even with a former peak-hour car-handling record exceeding 2000 cars-per-hour in one direction, however, serious traffic jams frequently backed up as many as 1400 cars at a time deep into Manhattan streets and far out along Jersey approaches, requiring from four to five hours to completely dissipate. Completion of the

Third Tube will break this serious bottleneck and will re-emphasize the tunnel's vital role in Manhattan's transportation drama.

Together with expanded approaches and toll facilities, this 8000-ft Third Tube represents an investment of over \$100 million (the two forerunners collectively cost \$88½ million) and (from initial ground-breaking to final ribbon-cutting ceremonies) the project represents almost five years of rough, tough construction.

Few jobs embrace more diversified trades and methods, or demand more coordination of joint effort, than do large tunnel construction jobs. This can be appreciated by considering just the electrical work involved, for this segment covered general and special lighting, high and low voltage supply and distribution, traffic and supervisory control systems, telephone and fire alarms, carbon-monoxide analyzing and recording equipment, code-call wiring for tunnel and ventilation buildings, toll-taking facilities and critically essential temporary power that literally constituted the tunnel's life-line during the long construction period.

This electrical work-scope was covered by various contracts total-ling approximately \$8 million and, for the most part, it was installed by electrical contractors Fischbach and Moore of New York City and Lightning Electric Service of New-ark, N. J. (who handled the major assignment as a joint venture), Jandous Electrical Construction Co., also of N. Y., who installed all temporary power supply and distribution equipment, and Plymouth Electric Construction Co.

Multi-Level Illumination

Each separate section of the electrical work merits special analysis and comment. For example, illumination within the Third Tube is provided by continuous rows of fluorescent fixtures, one row mounted along the top of either tiled side wall, with fixtures on opposite sides of the tunnel supplied from panelboards and transformers located in separate ventilation buildings on opposite sides of the river and therefore backed by completely segregated utility feeders and networks.

Lighting fixtures consist essentially of 12-ft Pyrex tubes, each containing two 72-in. T12 cool-



NIGHT VIEW of helix, taken prior to completion of plaza and toll-booth installation, shows spacing of 4-lamp inclined-arm fluorescent lighting standards. Floodlighting towers for additional plaza illumination are also visible. Lighted tower of Empire State Building may be seen in left background across Hudson River.



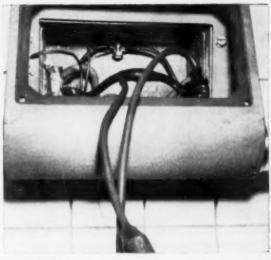
ILLUMINATION WITHIN THIRD TUBE is provided by 72-in, cool-white fluorescent lamps mounted in tandem in 12-ft Pyrex tubes and series-wired to operate on a multiple-distribution system having maximum 1200 volts-to-ground. Lamp sockets and ballasts are incorporated into streamlined housings, while ballasts may be disconnected without exposure of live parts through medium of plugreceptocles. Lights on opposite walls of tunnel are backed by transformers on opposite shores of river.



ROUND-THE-CLOCK traffic flow, with peaks of 2000 cars per hour in one direction, precluded shut-down for installation of lighting standards. Contractor therefore developed novel truck boom, offset to side so that erection of poles would proceed with only one traffic lane blocked. Luminaires are 4-lamp fluorescent units, inclined 15 degrees from the horizontal and mounted at 30-ft heights at 100-ft intervals.



SOCKET HOUSINGS spaced along upper side walls of Third Tube also contain series-reactor 2-lamp ballasts encased in watertight polychloroprene jackets. Ballasts are variously rated at 600, 445, 360 and 325 ma, resulting in gradual reduction of light intensity from portals inwards.



GROUNDING of fluorescent socket housings is effected through use of post connectors, No. 10 taps and compression lugs. Contractor developed novel sliding platform on top of truck, permitting workers to reach either side wall by shifting direction of platform overhang.

white lamps wired in series and operating on a 3-phase 4-wire multiple-distribution system having a maximum voltage-to-ground of 1200-volts. Housings supporting lamps and tubes also serve as enclosures for related series-reactor 2-lamp ballasts which are completely encased in watertight molded polychloroprene jackets. Ballasts are connected both to load and to feeder cables through plugs and receptacles (line connectors also being fused) so that ballasts may be disconnected without exposing any live parts.

From tunnel entrance inwards, ballast ratings are progressively charged from 600 ma to 445, 360 and 325 ma, resulting in the obtainment of gradually decreasing levels of lighting intensity.

Another method by which light output is regulated is by shifting tap-changing switches on control boards so as to deliver 1200, 1000 or 800 volts to the distribution system in accordance with desired results. Brightness values are checked constantly by photocell monitors, and regulation is initiated either manually or by astronomical clocks.

This flexibility permits portal lighting to be decreased at night-time or on cloudy days. Or, conversely, as lumen output of lamps within the tunnel proper falls off due to normal lamp aging or to lowered winter-time ambient temperatures, lighting intensities may

be maintained at a relatively stable level by progressively raising the voltage of the distribution system.

Lighting provided by this installation is commendable for (with continuous rather than intermittent light sources), wall scallop patterns, undulating intensities and pulsating highlights on car windshields and hoods of moving vehicles are completely absent. Also, through the use of variously rated ballasts and the regulation of voltage, lighting intensities may be varied or held constant as just noted. Complete disruption of electrical service is precluded by supplying opposite-wall fixtures from opposite-riverbank utility networks, also by staggering groups of lamps on different phases. And, by installing rugged Pyrex tubing over tandem-linked lamps, the lamps are protected from possible whipping by flapping truck tarpaulins; cleaning can be facilitated through the permissible use of high-pressure hosing; the number of lamp terminal sockets is reduced by half; and lamp replacement can be speeded by substituting complete pre-assembled 2-lamp tube units.

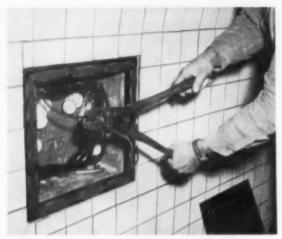
Tunnel lighting distribution transformers are single-phase askarel-insulated self-cooled units, a dozen 50-kva and a dozen 25-kva transformers being installed for this purpose. Primary windings (low voltage) have ratings for 480 volts, with taps brought out to bushings at 100%, 120% and 150%

of normal voltage in order to supply secondary (high voltage) levels of 1200, 1000 and 800 volts, respectively. In addition, secondary windings are equipped with four 21% full-capacity taps (two below and two above normal), also internal tap changers, so that further adjustment can be obtained through these mediums. All bushings are sidewall mounted and cans are additionally equipped with ground and lifting lugs, sampling devices and filter press valves, drains and liquid level indicators, and (on all 50-kva transformers) pressure relief diaphragms.

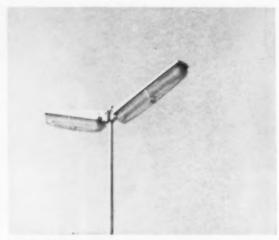
Control of lighting circuits is by means of 24 air circuit breakers and eight remote control switch panels, each breaker rated for 225 amps 600 volts and equipped with adjustable thermal magnetic interchangeable trips, and each remote control panel mechanically interlocked to prevent multiple simultaneous closing of switches. Panel buses are copper with capacities for 200 amps; joints are bolted, and contacts are silver plated. Also, to preclude the presence of moisture or the freezing of pivots, each cubicle is equipped with a 100-watt 115-volt screw-base heater mounted in a 660-watt 250-volt porcelain socket.

277 Volts for Plaza Lighting

General lighting for an expanded 18-booth toll plaza on the Jersey



CONNECTIONS between 6-gauge tunnel-lighting feeders and 12-gauge taps branching to lamp sockets and series-connected ballasts are concentrated inside adjacent junction box where compact splices were made through use of connectors applied by hand-powered compression tools.



RAPID START LAMPS operating at 277 volts and equipped with 90% pf ballasts are contained in these inclined 6-ft 4-lamp luminaires. Average intensity on roadway (initial) was 5 footcandles. Transformers are mounted in fixtures atop tapered, hollow pole.

side (plus sweeping approach ramps leading to it) is likewise fluorescent, with aluminum (enclosing-plastic) 4-lamp (100-watt 6-ft rapid start) luminaires cantilevered out from tapered standards at inclinations of from 10 to 20 degrees above the horizontal. Luminaires are equipped with internal 90% pf ballasts, and power distribution to standards is at 480Y/277 volts. Transformers supplying this power are askarel filled 45-kva units with 4160-volt delta primaries. Oil fuse cutouts for same are gang operated, while secondary switches are electrically operated mechanically held enclosed units having 120-volt operating coils arranged for 2-wire control.

For lighting the lanes of traffic passing between the 18 lefthand toll booths, 144 slimline fluorescent fixtures are flush-recessed into a continuous booth-protecting canopy. Fixtures are 2-lamp units (eight per lane), equipped with thick diffusing glass covers which are rubber-gasketed to obtain airtight enclosures for the retention of lamp heat during cold winter months. Lamps are separately circuited so that light output of fixtures may be regulated in accordance with variations in natural light or with seasonal temperature changes.

Above each traffic lane, two neon vehicle-classification indicators are housed in aluminum enclosures and are automatically activated by attendant-controlled motor-operated

tape machines that also record classifications of all vehicles, lane numbers, date, time and direction of traffic flow. Numerals are operated at lower voltage and half luminosity after sunset, reduction of voltage being automatically activated by astronomical clocks, transfer relays and auto transformers.

Safety-Regulated Ventilation

Just as continuity of illumination is essential in a tunnel where fast-moving traffic would pile up instantly if a sudden blackout occurred; so ventilation is vital to eliminate contaminating exhaust fumes. For that reason a constant flow of fresh air for the Third Tube is maintained by 24 giant blower and exhaust motor-driven damper mechanisms capable of providing a complete change of air within the tunnel every 90 seconds during peak traffic periods.

Since traffic volume and corresponding rates-of-accumulation of monoxide gas vary, however, related rates-of-air-change are adjusted through the use of multispeed variable-cfm fans.

Fans are variously 2- and 4-speed; a 2-speed fan being driven by one 2-speed motor, and a 4-speed fan being driven by one small plus one large 2-speed motor. Ratings of fans, therefore, have ranges from 5 to 7.5, 30 to 50, 70 to 105, and 250 to 350 hp. Correspondingly, 2-speed fans have shaft speeds of 95 and 190 rpm while

4-speed fans have rotational steps of 111, 223, 297 and 445 rpm.

Fans may be individually controlled from local pushbutton stations (for maintenance purposes) or they may be collectively controlled from central stations in which bus, starter and switch compartments are isolated from each other by full-height metal barriers.

At such stations, (1) incoming power is top-connected to boards; (2) main 3-phase 3-wire buses are rated for 460 volts, 600 amps; (3) damper-control auxiliary buses (also isolated) are 3-phase 4-wire 120/208 volts; (4) doors are keyinterlocked with 460-volt air circuit breakers to insure doors being opened only when breakers are likewise in the open position; and (5) boards are additionally equipped with damper and speed indicators, speed-selection and transfer switches.

Contactors on control boards are magnetically operated and held (holding power of larger coils going to 200 watts and that of the smaller coils going to 50 watts), while all contactors are certified for making-and-breaking 50 times (at 10-second intervals) under six times normal full-load and voltage conditions.

Essentially, each of the 24 automatic fan control units consists of a magneto with assemblies of condensers, reactors and transformer related to relay controls and speed indicators. Reactors and condensers are adjusted for tuned frequencies

(corresponding to speeds 1 and 3 for a 4-speed fan unit; speed 1 only for a 2-speed unit), while each tuned circuit energizes a sensitive dc relay through a full-wave bridge-type selenium rectifier. Relays drop out between 80% and 95% of fan speeds for which they are related, while pick-up levels are approximately 115% of drop-out values.

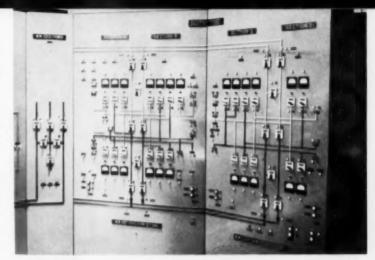
Following general practice, fresh air is introduced into the tunnel through a continuous plenum chamber formed by the roadway slab and the tube's bottom invert, and it is exhausted through the equivalent duct space between the tunnel's suspended ceiling and the arched concrete sheathing. Actual introduction of fresh air to the traffic area is through intermittent supply ports located just above curb levels on either side, while passage of exhaust fumes into the overhead chamber is through vents closely spaced above both traffic lanes.

Constant Analysis of CO

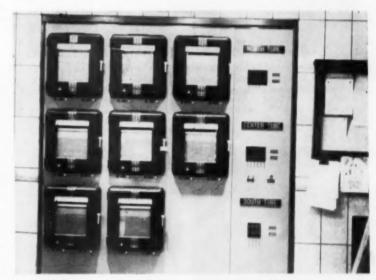
Operation of ventilation equipment is constantly adjusted so that concentrations of carbon monoxide within the tunnel are kept below the super-safe proportion of 21 parts per 10,000 units of air (which, incidentally, is considerably better than the atmosphere on many metropolitan city streets). Air samples in the tunnel are continuously collected by closely spaced CO detectors, then relayed to an automatic analyzing center where a constant record is kept by singlepoint curve-drawing recorders. Recorders, having chart speeds of 2 in. per hour, are equipped with readily visible position indicators for distant reading, indicating light-and-bell alarms to notify supervisors when CO concentrations approach the established limit of safety, and vapor-proof cases with chart re-rolling mechanisms. fluorescent lights and switches to control lights and motors.

Power Insurance

To insure continuity of power for ventilation purposes, fan motors on both sides of the river are served through dual feeders backed by separate free-standing deadfront double-ended substations. Each sub consists of duplicate askarel-filled self-cooled 1000-kva transformers, electrically operated



PANELBOARD in ventilation building visually shows existing circuit conditions through mediums of mimic bus structures, colored indication bullseyes, name-plates, meter dials and breaker-position switches, an assembly which takes the guess-work out of control and insures accurate understanding of all power-routing and equipment operation problems.



CO RECORDERS in supervisory control room continuously show carbon monoxide concentrations in all three tubes, this information obtained via closely spaced detectors in tunnel plus automatic analyzing equipment. CO conditions are also permanently recorded on moving charts by single-point curve-drawing pens.

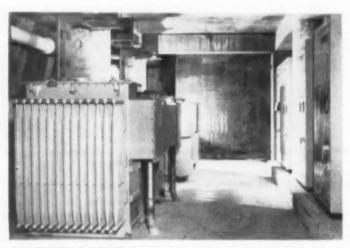
1600-amp main and tie breakers, and manually-operated 600-amp circuit breakers.

Primary power to these various substations is at either 13.2 kv or 4160 volts, 15-kv cables connecting to transformer terminals through potheads and busbars, and 5-kv cables terminating through sealing bushings and stress cones. Secondary power is uniformly at 460 volts delta, regardless of primary voltages, and all breakers except ties are equipped with magnetic overload attachments and auxiliary switches.

All main and tie breakers (rated for 50,000 amps ICs) are draw-out units, so constructed that all readily accessible components are dead (regardless of breaker position) whenever cubicle doors are opened. Main and tie breakers (electrically operated from a supervisor's remote control station) are also interlocked so that no tie can be closed to parallel any two feeders by connecting two buses together. Mechanical closing of main and tie breakers is impossible while they are in the operating position, although a tie breaker may be closed



MAINTENANCE PROGRAM is continuous, routine inspections and servicing procedures being facilitated and safeguarded by such factors as uncrowded placement of equipment, permanent platforms for men to stand upon, proper guards in front of moving parts, ample local illumination, good ventilation, filtered air supply and the like. Size of equipment is indicated by this air-supply fan.



CONTINUITY OF POWER for ventilating fans on both sides of the river is insured by dual primary feeders and duplicate transformers, two with 13.2-kv primary service, two with 4160-volt primaries, and all with 460-volt secondaries. Main and tie breakers are draw-out electrically-operated units. Ties consist of low-reactance enclosed buses.

when the breaker is withdrawn to the testing position, and a main breaker may be closed by intentionally using a key interlock. All switchgear breakers (primary and secondary alike) are interchangeable wherever ratings are equal. In addition to the above, there are two auxiliary 120/208-volt transformer stations, together with essential-service bus structures, both automatic (electrically operated, mechanically held) and manual transfer switches, plus electric

heaters and related relay assemblies. Automatic transfer occurs whenever normal line voltage drops below 70% of its rated value, returning the emergency load to the initial source of power again when normal voltage returns to 90% or higher.

Momentary operating current for all air circuit-breakers (located in the two ventilation buildings) is supplied by three 60-cell lead-acid batteries (glass jars with sealed ventilated covers) having a collective capacity of 720 amp-hours (on the basis of an 8-hour discharge rate) and a total one-minute rating of 1069 amps. Batteries normally operate under a floating service plan; that is, the chargers carry the normal load and also provide a trickle charge for the batteries. Only in cases of emergency do these batteries provide current for relays and indicating lights.

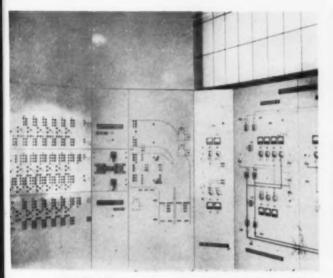
Chargers are m-g sets (two sets at each of three battery locations), 7½-hp motors and 5-kw generators for 208-volt service, and a 5-hp motor and 3-kw generator for 440-volt service.

Central Supervision

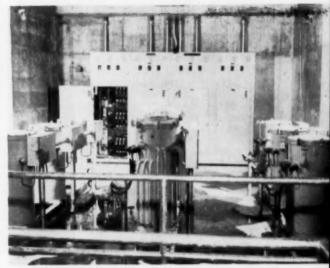
In addition to monitoring the presence of monoxide, adjusting ventilation equipment and remotely regulating tunnel and plaza lighting, the main control station is equipped to supervise communications and traffic.

Traffic signal lights in the tunnel are mounted on cast iron boxes located intermittently over both lanes while, in addition, local control stations are located in boxes (having zone flasher and telephone signal lamps) recessed into the northern wall along police walkways.

Detailed discussion of the entire traffic control system is considerably beyond the scope of this article, for wiring (including five miles of approach signals) is so extensive and intricate that a basic small-scale drawing of the system covers a 100-sq-ft area, while related specifications constitute 28 typewritten pages. Suffice it to say that, since the center tube and its associated approach roads are designed for either west- or eastbound traffic (depending upon prevailing traffic requirements), traffic signals include not only the usual red, green and amber lights, but also a complex system of illumi-



SUPERVISORY board for traffic system controls signal lights in all three tubes and along approach highways. System is complex, including illuminated directional arrows, signs, alarms and colored traffic lights, Stoppage of traffic would initiate simultaneous operation of all orange warning lights in lane leading to the stoppage point, with red stop lights then operating in reverse progression.



STEP-UP TRANSFORMERS related to tunnel-lighting installation have low-voltage primaries at 480 volts, and secondary taps to provide 800, 1000 or 1200 volts, as required. Secondary windings are also equipped with four $2\frac{1}{2}\%$ capacity taps (2 above and 2 below normal) and internal tap changers for exact adjustment. Lighting control board may be seen in background.

nated diversion arrows, traffic signs, visible and audible alarms, plus numerous additional control stations, all in addition to the master traffic-control board.

There is also a traffic alarm board located in an emergency garage at the New York portal, the board containing pilot lights to designate the tunnel control station originating a call, other lights to designate what type of motorized equipment (such as a jeep, tractor or fire truck) is required for the emergency, a traffic alarm buzzer and pushbutton to acknowledge the call and to ring a bell at the portal where traffic is to be halted, plus nameplates, luminous arrows, relays, terminal blocks and code-call bells to further clarify emergency directions and actions.

Signal lamp circuits may be energized either by a tumbler switch on the supervisory board, or by energizing any one of six tunnel alarm lines originating from six tunnel sections. In the latter case, a synchronous motor and flasher unit (having the capability for 60 on-off equal-length contacts per minute) would flash a code signal to identify the section of tunnel originating the call. Should alarms originate simultaneously from more than a single section, codes of the various sections having trouble would be flashed successively, being separated by 4-second "on" periods.

Another potential source of trou-(i.e., trucks with heights greater than tunnel clearances) can be detected before it develops, because approach roadways are guarded by photo-electric beams of light which, (if interrupted by moving objects 13 ft or more above road level) activate relay-controlled warning horns that not only advise portal traffic officers of this condition, but also stop traffic by automatically changing traffic signals from green to red. After the overheight vehicle has been spotted, halted and diverted from the approach, green traffic lights may be returned to service and warning horns silenced through operation of conveniently located reset buttons.

Wiring Details

This brief discussion of the electrical installation covers only the more outstanding high points, omitting comments on scores of special lighting methods and on such additional details as pumps, electric hoists, compressors and so forth. In general, however, it may be added that all conduit in the tunnel is rigid galvanized steel and, where exposed, is secured to brick or concrete by expansion bolts, or secured to steel by means of welded

bolt studs. Prior to pulling-in of wire, conduits were cleaned, reamed and checked for obstructions either by drag cables or (in conduits larger in diameter than 2½ in.) by flexible round mandrels (½ in. smaller than conduit IDs). All conduits are brass-tagged for positive identification at all junctions or intermediate boxes or chambers, and (where they terminate in masonry pits, handholes or manholes) they are also grounded by means of bushings and No. 6 ground connections.

For double identification, power wires and cables are additionally labeled in all enclosures, using nonferrous embossed tags for that purpose; and low-voltage signal control and supervisory systems are identified by adhesive terminal marking strips.

Terminal connections of wiring (600 volts or less) are made with clamp-on lugs and locknuts, while splices are obtained variously by means of spring connectors (with wires twisted before inserting) as well as by indentor or pressure type connectors, then insulated overall with double layers of half-lapped Scotch electrical tape.

While complete bill-of-material statistics related to this king-sized electrical job will not be included in this discussion, some indication of the work-scope can be obtained by mentioning that over a million feet of neoprene-jacketed wire and cable were installed, including 5000and 15000-volt high tension lines for power distribution, 2000-volt lines for lighting, and 600-volt wiring for traffic signals and supervisory control.

5 Years of "Temporary" Power

To insure uninterrupted power for air compression, mucking equipment, discharge pumps and lighting during the long construction period, three independent 3-phase, 3-wire, 4160-volt sources of primary current were made available at the jobsite. This necessitated (1) the erection of several miles of high-tension pole-lines: (2) the installation of four transformers to step power progressively down to utilization levels of 2300, 440, 208 and 120 volts; (3) the provision of compressors, with a total piston displacement of 23,000 cfm of fresh air at 50 psi; (4) five more compressors for supplying 100-psi air for operating drills and grouting machines; (5) the installation of drive motors for these compressors, with ratings up to 800 hp; (6) two 100-hp 21-gpm 6000-pounds-pressure hydraulic pumps, plus (7) automatic as well as manual power transfer control facilities, with mechanical interlocks to prevent improper sequencing.

Two separate sources of power were also provided for lighting purposes, wiring (3 single conductor No. 4/0 RWs with one No. 1/0 neutral) being supported on porcelain cleats which were in turn supported by dowels driven into holes drilled into rock walls or, later, secured to the ceiling invert of the tunnel's cast iron casing. Lamp sockets were non-metallic weatherproof units, supporting 500-watt lamps spaced on 30-ft centers; lamp fixtures were variously aluminum explosion-proof, brass keyless or galvanized bracket units; while grounded wire cages were fitted around lamps plus the sockets holding them.

Safe Tunneling Practices

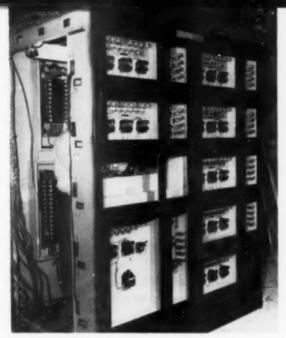
As a safety measure, lights within a distance of 100 ft of the heading were disconnected each time blasting holes were charged (to prevent the possibility of an electrical contact from prematurely detonating a charge). Temporary



TUNNEL LIGHTING BOARDS contain breakers, pushbuttons (above) for selecting high-, medium- or low-voltage connections (1200, 1000 or 800 volts) from transformer bushings, plus indicating bullseyes in doors to visually show which voltage level is in service. Doors are kept locked and voltage taps can be changed only from pushbuttons located inside, thereby preventing remote or unauthorized activation of the system.



LARGE DUCTS, for power distribution as well as for coaxial long-distance telephone cables, are secured to cast-iron segments of the tunnel prior to concrete and tile facing of walls. Smaller conduit noted above carries feeders for lighting system. Wiring related to all signaling and communication systems (with exception of telephone) is carried along opposite wall beneath police walkway.





FRONT AND REAR views of panel related to traffic control shows extent of relay arrangement for synchronizing lights and the resulting flow of vehicles through the three tubes and along long approaches to portals. Traffic lights may be controlled from individual local stations, from the control desk in the Jersey ventilation building, or from the master control center.



RECEPTACLES for connection of maintenance vacuum cleaners are spaced through overhead exhaust plenums, splicing of receptacle legs to feeder cables being made via crimped sleeves which were subsequently double-taped. This provision for maintenance keeps dust and debris from accumulating in this ventilation duct area.



5-KV FUSES related to low-break switches on 4160-volt primary service lines are inspected for compliance with specifications. Primary service then continues on to banks of double-ended substations where current is initially stepped down to 460 volts delta. Primary cabling is through sealing bushings and stress cones when power is at 4160 volts.



SPLICING of color-coded control cables was exacting assignment, since cables carried from 250 to 350 conductors each. Control cables shown here are related to all signalling and communicating systems with the exception of telephones. Wires are 14- and 16-gauge, with indented compression links establishing the connections.

illumination during these periods was provided by insulated floodlight units positioned at a considerable distance from the working face of the tunnel.

Another safety provision was the installation of dual communication systems: (1) regular outside telephone circuits running down shafts to connect emergency locks, compression headings and air chambers

with power houses and field offices, and (2) auxiliary crank-operated battery-operated systems extending directly between headings and field offices.

The critical importance of these various temporary services can be better appreciated by visualizing the "business side" of a compression chamber during construction of a tunnel, for then one would find

a starkly naked 31-ft-diameter tube filled with the roar of mucking machines; the grind of rock and squash of silt as 28 hydraulic jacks each exert a 200-ton thrust to shove the 240-ton shield further forward through the river bottom; the steady heart-like flip-flop of the intake valve on the compressed air vent; the scrape of the erector arm as wall segments are swung into



DURING CONSTRUCTION, power for air compression, discharge pumps, mucking equipment, welding and lighting was provided through three independent 3-phase 3-wire 4160-volt primary services, plus series of transformers for stepping current to various utilization levels of 2300, 440, 208 and 120 volts. Wiring for lighting inside the tunnel consisted of three single No. 4/0 RW conductors with one 1/0 neutral.



NON-METALLIC lamp sockets, containing 500-watt lamps spaced every 30 ft, were served by cables supported on porcelain cleats which, in turn, were supported (first) by dowels driven into holes drilled into rock walls, then (later) secured to the cast-iron segments of the tunnel's shell. To prevent possibility of electric contact prematurely detonating a charge of dynamite, lights within 100 feet of the heading were disconnected whenever blasting holes were charged.

position; and the terse shouts of sandhogs as they strain against their heavy wrenches. Under these conditions, where progress through rock and muck varied from a few inches to only a few feet per workshift and where air compression sometimes reached 28 psi, one realizes that continuity of power, light and air are the life-blood of successful tunneling.

For these reasons, power sources, distribution mediums and all vital equipment was installed in duplicate; experienced engineers, maintenance and medical men were in constant attendance; and pressure gauges and electric meters were monitored at all times by veteran sandhogs and watchmen.

After the tunnel had been "holed through" and air compression was no longer necessary, yet before permanent CO recorders and ventilation equipment had been installed, portable CO recorders and fans were used to minimize air pollution.

Precautions such as these were in most cases redundant, for serious accidents on this job were practically non-existent. The precautions, however, added up to spell Safe Tunneling which, at best, is a fairly rugged way to earn an honest buck. And, come to think of it, this construction picture is a rather far cry from the faultlessly lighted gleaming-white tiled tube that is viewed by motorists whizzing through the completed tunnel.

Credit for this mammoth electrical installation is as extensive as the job itself, for it owes its existence not only to the contracting firms of Fischbach and Moore, Lightning, Jandous, and Plymouth, but also to such Port of New York Authority personalities as Chief Engineer John Kyle; Design Engineers R. F. Schaefer and I. G. Gould; Consultants Ralph Smillie and Charles Crandall; Coordinator Robert J. Western; Construction Engineer Louis F. Booth; Electrical Inspectors Job Braen, Walter Amlung, and Carl Papaleo; and Resident Engineers Henry Druding and Joseph Gavin. Overall direction was by Project Supervisor Winfield Rose (Lightning), who was backed by E. Clark Andrews (Fischbach and Moore), Asst. Proj. Supv.; and by Leon Berman (F&M), E. Levine and S. Richman (L), Project Engineers.

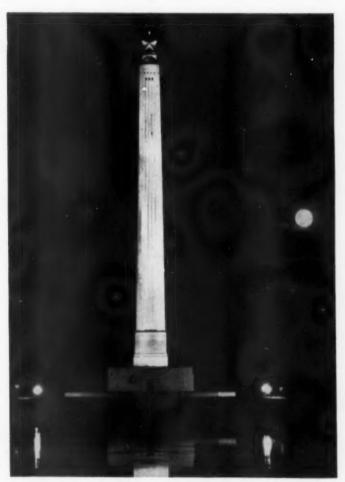


ROUTING OF TRAFFIC during construction period required constant changes and strict supervision, as indicated by this progress photograph which shows five of 18 new driver-side toll booths (left) completed, 7 old ones demolished and 6 old ones yet to be replaced. Lane numbers, date, time and direction of movement of all vehicles is recorded by motor-operated tape machines.

Design Considerations for

MONUMENT FLOODLIGHTING

The toughest floodlighting jobs can often be done easily through the practical approach.



AT NIGHT tower glistens even more brightly against sky by contrast than during day, as searchlights and floodlights dramatically accent the vertical shaft.



SAN JACINTO MEMORIAL, Pasadena, Texas, towers 570 ft above historic battleground and glistens in bright sunlight. Structure at base of tower is a

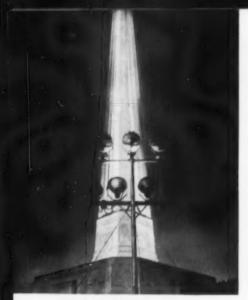
THERE are three practical considerations that electrical contractors always find themselves accountable for when called upon to floodlight monuments, statuary, or public shrines: (1) locating the floodlight units as obscurely as possible; (2) achieving proper illumination intensities; and (3) selecting equipment that best suits the job.

The first consideration, laying out the floodlights inconspicuously, meets the esthetic requirements for the monument site. Light beams must always appear part of the monument; and only when the sources of light are unnoticeable is this effect fulfilled.

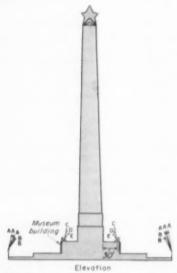
The second consideration, proper illumination intensities, means focusing light in precise amounts on those parts of the monument that will make them appear as natural as they are in broad daylight.

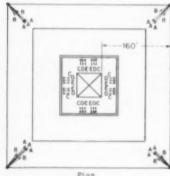
To secure adequate performance from monument floodlighting, care should be taken that the equipment is earmarked for the job it is expected to do; it should be well-built, capable of years of nightly service. Though obscurely located, the floodlight units should be easily accessible for cleaning or relamping. If mounted out-of-doors, they must withstand severe changes in temperature and damage from water or dirt.

Unlike the multitudinous floodlights of most building or sports arena lighting systems, monument floodlighting calls for few units—



POLE MOUNTED floodlights at each of four corners of base project light to shaft, and have proper light distribution to bathe shaft in even illumination.





LOCATION AND TYPE of floodlights are shown on the plan and elevation of the San Jacinto Memorial, above.

usually searchlights or a combination of searchlights and floodlights. Ideal for monument floodlighting, the searchlight accurately pinpoints a bright patch of light over a long distance and still meets the standards for attaining proper brightness of the structure as well as color and brightness contrast of the object with its background.

Both searchlights and general purpose floodlights used for monument floodlighting are usually of the enclosed, heavy duty type units, of cast aluminum, built to withstand strong punishment. Gasketed, watertight fittings are used to protect lamp receptacles and reflectors. The hinged door of each unit, containing a heat resistant lens, should clamp tightly to the housing. The housing and door assembly may be supported by a steel U-frame which allows for both horizontal and vertical adjustment.

Aside from modifications in capacity and size, searchlights differ from floodlights principally in reflector design. The searchlight reflector provides a concentrated light pattern with a 2° to 5° spread, and also has an auxiliary reflector to redirect the normal spill light into the main reflector, thereby boosting the fixture's efficiency.

To point out dissimilarities between monument floodlighting techniques and other common floodlighting applications, such as public buildings, stadia, or commercial or industrial structures, here are two typical examples—exterior floodlighting of the San Jacinto battlefield monument, Pasadena, Texas, and interior floodlighting of the Thomas Jefferson statue in the Jefferson Memorial, Washington, D. C. Both installations were engineered and equipped by Crouse-Hinds Company.

Exterior Monument Floodlighting

Constructed in 1937 to commemorate the battle that won independence for Texas from Mexico, the San Jacinto Memorial stands 570 ft above the battlefield. At its base is a museum, the walls of which are inscribed with historic data about the battle. The monument is crowned with a gigantic five-pointed star, carved in full relief to symbolize the state of Texas. Vertical lines of the monument are broken at its base by four panels of sculpture in low relief.

Monument's floodlighting is located in two distinct areas. At each of four corners, 160 ft away from its base, seven floodlight units are clustered on a steel pole 18 ft high-three 1500-watt searchlights, two 1500-watt and two 1000-watt floodlights. The 1000-watt units are equipped with 400-watt mercury vapor lamps, and are not intended to beautify the monument but rather to provide illumination throughout the night that will provide light for protection while the main lighting is off. Some of the searchlights shine directly on the Lone Star ornament atop the memorial.

Along each side of the museum roof, 30 ft from the monument base, six floodlights are arranged along the inside of a 7-ft high wall that borders the edge of the roof (see sketch). These floodlights cover the bulk of the monument's lower surface. Floodlighting for one side, for instance, consisting of type ADE-16 units, is arranged as follows: at the ends, two units (C) are equipped with plain lenses and 1000-watt, G-40 floodlight service lamps; next to them are two units (D) equipped with 50-degree vertical spread, clear lenses and

Floodlight Schedule for San Jacinto Memorial

No.	Туре	Description	Lamp	Bulb
12	A	Type DCE-18 searchlights (C)	1500 w.	G 48
8	В	Type LCE-1120 floodlights (PL)	1500 w.	G 48
8	BI	Type ADE-14 floodlights (PL)	400 w.	H400
8	C	Type ADE-16 floodlights (PL)	1000 w.	G 40
8	D	Type ADE-16 floodlights (SPV)	1000 w.	P552
8	E	Type ADE-16 floodlights (SWV)	1000 w.	P552

1000-watt, PS-52 general service lamps; and in the center, two units (E) with 100-degree vertical spread clear lenses, also are equipped with PS-52 lamps. Each pair of floodlights illuminates a vertical section on the lower third of the monument which, added to other lighting, provides even illumination over the entire structure.

Interior Monument Floodlighting

Focal point of the Jefferson Memorial, in Washington, D. C., of course, is the heroic statue of Thomas Jefferson. It is 19 ft tall and stands in the center of the memorial room upon a pedestal of black Minnesota granite reaching 6 ft from the floor. It stands in marked contrast amid the memorial's interior of white Georgia marble. The four colonnaded openings of the memorial-two on the east-west axis, and two on the north-south-make it possible to view the figure from many different angles.

The memorial's main entrance faces north. As visitors approach this entrance, they see the statue in bold relief against a sky exposed by the south entrance. In addition, the statue, being almost black, absorbs rather than reflects light. Without artificial illumination, its features are indistinguishable.

To remedy this problem, the National Capitol Parks Service installed nine stage type spotlights, equipped with 1000-watt, 115-volt lamps, in the rotunda on the north end of the memorial. These spotlight units were mounted behind the rotunda ceiling, approximately 50 ft from the floor and 8 ft apart. so as to project down at the statue through oval shaped apertures cut out of the ceiling. But the illumination output of this arrangement proved unsatisfactory. So that the statue's features might be seen clearly against the background of the sky, National Capitol Parks' electrical specialists estimated that 200 footcandles would be necessary.

As a test, eight Crouse-Hinds type DCE-12 searchlights equipped with 500-watt, 115-volt spotlight display lamps replaced the stage type spotlights. They were mounted temporarily along a horizontal parapet in the rotunda, and demonstrated for the benefit of the Parks Service and Rudolph Evans, sculptor of the statue.

The test disclosed not only that



STATUE of Thomas Jefferson faces main (north) entrance of Jefferson Memorial, Washington, D. C., standing out in bold relief under 200-footcandle illumination provided by 12 500-watt spotlight lamps in Crouse-Hinds search



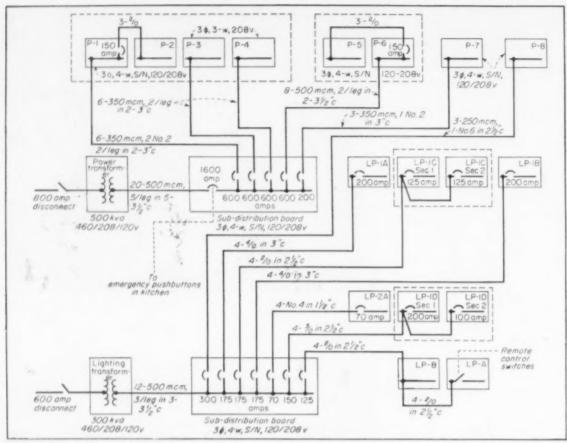
FOUR COLONNADED openings in Jefferson Memorial—two on east-west axis—two on north-south axis—expose statue to sunlight from many angles. High intensity lighting is necessary so statue's features are discernible during day when viewed against natural light.



SEARCHLIGHTS are mounted 8 ft apart behind rotunda ceiling, approximately 50 ft above floor, and aimed through ovalshaped openings cut in the Georgia marble ceiling. Average intensity on statue's surface from 12 500-watt units is 200 footcandles.

the searchlights set off the statue's features clearly—even in broad daylight—but that a reading of 200 footcandles on the statue's surface was obtained. In fact, four additional searchlights were incorpo-

rated into the system which, after the ceiling apertures were enlarged to accommodate the 12-in. diameter searchlights, were placed in the accessible area between the rotunda ceiling and outer roof.



DISTRIBUTION DIAGRAM shows wire and conduit sizes, main breaker ratings and equipment designations,

800 kva for ALL-ELECTRIC DINING

TABLE I: Kitchen Heating Load

		_
Item	No.	Kw(each)
Ranges	5	21.9
	1	18.6
Bake Ovens	2	18.6
Broilers	2	30
Roasters	. 1	30
Fryers	4	12
Hot Tables		10.9
Coffee Urns		9
Toasters		2.7
	4	2.5
Soup Warmer	1	3
	2	1
Coffee Warmers	6	2.14
Roll Warmers		1.2
	2	.8
Food Warmers	4	1.2
Lowerators	4	.5
	3	. 8
Cup Dispensers	2	. 8
Proof Box	1	.75
Misc. Heaters	12	12.3 kw toto

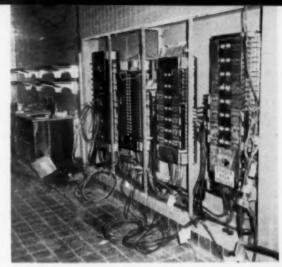
Two low-decibel transformers of 500 and 300 kva capacity provide electric power and light for seven dining rooms, a lounge, a cafeteria and associated food-preparation areas at new Socony-Mobil building in New York.

RANGES, ovens, roasters and dozens of other modern cooking appliances together with an abundance of contemporary lighting ideas permit quiet, relaxing dining for more than 1200 employees and management personnel at New York's new Socony-Mobil building.

Source of the 800 kva necessary to supply these loads is two Sorgel low-decibel 460/280Y/120-volt drytype transformers rated at 500 and 300 kva. Although located in the basement, the transformers are immediately below the private dining room area, and the possibility of freak sound transmissions to the upper parts of the building made it advisable to take every precaution to minimize transformer noise. The 500-kva unit has a sound



TRANSFORMER VAULT in basement houses the two low-decibel dry-type transformers, their disconnects and the two sub-distribution boards. Shown above are the 500-kva transformer and the face of its sub-distribution board.



POWER PANELS P-1 through P-4, shown during construction, are recessed into wall in main kitchen area. These panels feed broilers, coffee urns, ranges, fryers, oven and miscellaneous kitchen heating equipment.

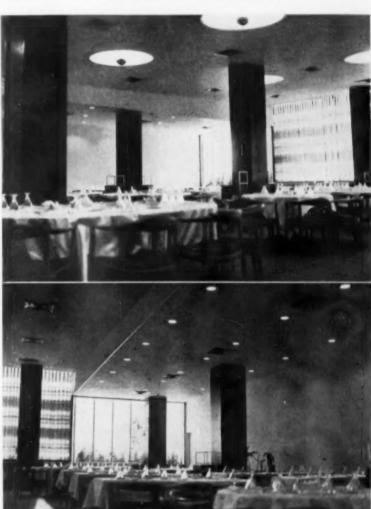
DINING ROOM "A", the largest of the seven, has four types of lighting fixtures integrated to create the illusion of daylight despite the fact that all dining rooms are below ground level. The bright window effect at both ends of the far wall is created in each case by six vertical troughs with continuous, lacquered, brass-alloy reflectors, each concealing two 40-watt T12 warm white fluorescent lamps in tandem. The lamps, on 2¾-ft centers approximately 2 ft in front of a white wall, create uniform lighting over the entire area which, with a liberal variety of house plants at the "sill" level, completes the window effect.

The draped area across the center portion of the same wall, visible in both photos, is backed by a similar white wall, but illumination is provided by 75-watt PAR 38 spots 6%-in. on center, housed low on the wall in recessed continuous incandescent trough. Lamps equipped with spread lenses are mounted to direct their light vertically. The front of the drapery is lighted from above by a total of 18 150-watt R-40 floods in ceiling-recessed Alzak reflectors.

Lights in dropped ceiling over tables are recessed Fresnelens Downlites with black ceramic risers, each housing a 75-watt A-19 inside-frosted lamp. Large circular ceiling fixtures in center of room are indirect Domelites, each containing one 250-watt G-30 inside-frosted flood lamp.

level of less than 50 decibels; that of the 300-kva is less than 46 decibels. These sound levels were attained during manufacture by ample core and coil design and careful cleaning, cutting and tight-fitting assembly of laminations.

These two transformers serve the function of reducing the 460/265-volt main distribution voltage with which the building is wired to the



ELECTRICAL CONSTRUCTION AND MAINTENANCE . . . JUNE, 1957

120/208-volt level required for the kitchen and dining room load. Distribution from the two transformers is radial. The 500-kva transformer feeds seven power panels by means of a sub-distribution board through a 1600-amp main breaker. Emergency pushbuttons mounted directly on the electric range equipment in the kitchen make it possible in case of emergency to kill this entire load by remote tripping of the 1600-amp main.

The smaller of the two transformers feeds the lighting load and miscellaneous pumps, fans and compressors through a second sub-distribution board. Both transformers, their disconnects, and the two sub-distribution boards are located in a single vault in the basement; the power and lighting panels are spotted centrally in the areas which they serve.

An examination of the kitchen loads in detail will give an excellent cross-section of the types and ratings of commercial cooking equipment in use today. Table 1 lists the heating load, Table 2 the motor load. Most of the load taken by the cafeteria, lounge and seven dining rooms is lighting; equipment and lighting are shown by photos.

Electrical consulting engineer for the building was Edward E. Ashley; Krey and Hunt engineered the kitchen electrical equipment; electrical contractor was Fischbach and Moore, Incorporated—all of New York.

TABLE 2: Kitchen Motor Load

Item	No.	Hp (each)
Refrigerators	1	3/4
	6	1/2
	2	1/3
Dishwashers	1	5
	1	2
Prewashers	-	3/4
Glass Washers	2	1/6
Meat Saw	1	1 1/2
Meat Chopper	1	1/3
Ice Cream Cabinets .	3	1/4
Ice Cream Makers	2	3/4
Mixer	1	1/3
Silver Burnishers	2	1/3
Water Stations	3	1/2
Elevator	1	6
Misc. Compressors	20	49 hp tota
Misc. Fans	4	14 hp tota
Misc. Pumps	4	22 hp total
Misc. Blowers	12	2 hp total



KITCHEN area lighting is accomplished with recessed troffers, each containing three 40-watt T12 standard warm white fluorescent lamps (120-volt ballasts) with low-brightness lenses, alternated with recessed Controlens Downlites housing 150-watt A-23 inside-frosted lamps and designed to fit into a 12 by 12-in. opening to match the foot-square tiles which cover the ceiling. Fluorescent and incandescent lamps are separately switched, giving two levels of illumination as required.



DINING ROOM "E" features an unusual pendant circular indirect trough containing 27 60-watt T-8 Lumiline lamps set end-to-end around the circumference of the trough. The 14-ft-diameter fixture is constructed of ½-in. bronze and is suspended 20 in. below the ceiling by woven cable supports. Downlites contain 75-watt A-19 inside-frosted lamps.

DINING ROOMS "F" AND "G", divided by a folding door which permits expansion into one large room, each have a main 3-lamp pendant fixture with lacquered, solid brass reflectors and 200-watt incandescent lamps. Also visible in photo is a recessed pinhole Downlite with 250-watt G-30 flood lamps, and a recessed Fresnelens Accentlite with a 100-watt G-16½ clear spot lamp illuminating the wall plaque. The end walls of these dining rooms are lighted by single rows of T-8 standard warm white fluorescent lamps in continuous ceiling-recessed troffers with louvered-bottom reflectors.

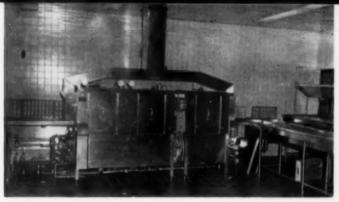




FOOD WARMERS are used to hold all types of food and baked goods after it has been prepared; heating elements are energized by plugging portable cord into any of numerous wall and column receptacles. When needed, food is wheeled to cafeteria and transferred to counter steam tables.



PROOF BOX combines a heater and humidifier to aid in raising yeast dough.



DISH WASHING UNIT in small scullery is hand-fed by means of roller conveyor at right; motorized belt takes dishes through a pre-rinse, a wash and a final rinse, where a liquid dryer is applied.



FOOD WARMER cabinet at left is used to transport food from kitchen to cafeteria; similar drawer-type unit is built into cabinet at right to keep rolls warm and crisp. Hot plates are used to boil water for tea; refrigerator is built into cabinet below hot plates Unit to left of refrigerator is a combination plate and cup lowerator which keeps cups and plates warm, as top dishes are used, spring action pushes others up within reach.



BAKE OVENS—two banks, three ovens per bank. To left of ovens are countertop hot plates for making icings and custards. At right is panel of paging system, used also as intercom for relaying telephone messages and instructions to kitchen personnel.

Civil Defense Warning System

New electronic system provides distinctive Civil Defense warning signal for 6000 Government Printing Office employees, consists of sirens powered by the standard building electric service and electronically controlled by carrier current over the existing program bell system.

ROVISION and installation of a new type of automatic internal Civil Defense warning system was completed recently in the Government Printing Office in Washington, D. C. This action was in conformance with the established policy of providing GPO employees with the advantage of every safety procedure and protective device known to the Graphic Arts industry. The new warning system provides a distinctive and unmistakable warning signal, similar to the approved signals of the Federal Civil Defense Administration, for the approximately 6000 GPO employees. It covers a floor area of over 31 acres in four adjoining buildings.

The new system consists, basically, of a control panel for receiving and decoding different impulse signals which are sent out by telephone from the local Civil Defense Administration headquarters, a four-channel frequency generator transmitter, an isolation transformer and the existing program bell circuit system, and approximately 50 electronic receivers and sirens. This system was selected and installed only after the merits and disadvantages of many systems and methods of providing a plantwide warning system, that would be both adequate and economical, were considered.

Because of the size of the area to be covered, it may be seen that to provide Civil Defense warning to all employees throughout the entire plant presented many problems. Further, these problems are aggra-

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Electrical Engineer Government Printing Office Washington, D. C.

vated by the high ambient noise level present in many of the areas, created by the printing machinery.

The former Civil Defense warning system in the GPO plant consisted of the sounding of program bells and use of the autocall paging system. The appropriate signal was initiated manually, from the central guard office. Notification of the warning of an attack would be given by the Civil Defense Administration, District of Columbia, over the lines of the local telephone company (Chesapeake & Potomac Telephone Co., Washington, D. C.). These telephone lines terminated in a "bell and light" signaling device, with indicating "yellow", "white", "blue" and "red" lights, and a bell operated at the ringing frequency of the telephone system.

In order to have a firm basis of evaluation for a new and improved system, certain criteria upon which the various systems were to be evaluated were set up. These were:

1. The warning signal must be distinctive and unmistakable.

2. The warning signal must not be confused with any other signal (program, paging or fire).

The signal shall be initiated automatically by the "Bell and Light" Civil Defense warning system, and also manually.

The system shall be economical.

 The system shall produce a warning signal the same as, or similar to, the Federal Civil Defense Administration approved signals.

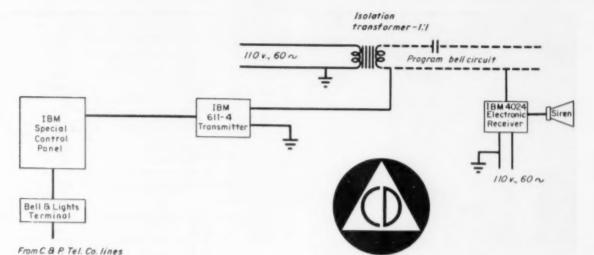
Sirens Adopted

The use of bells, gongs, horns, whistles, etc., was ruled out—since all these devices are already used for other signals. It was therefore determined that the audible signal would be generated by sirens.

Sirens have the advantage that they conform to the established city-wide Civil Defense warning system. Another advantage is that the psychological reaction to a siren results first in arresting attention, then inciting action in the listener.

In order to determine the output and tonal range of the siren to be used, sirens of different decibel rating and pitch were tested for penetration and audibility in high and low ambient noise level locations. From these tests it was determined that a siren having a decibel rating of 112 db at 10 ft and a maximum frequency of 700-740 cps was the best for application in the GPO buildings.

A higher rating than 112 db was considered inadvisable, since in indoor application this level approaches the normal threshold of pain and is below the level where aural damage could normally occur. Sirens of both a lower and higher frequency did not penetrate or attract the attention of personnel to the extent the 700-740 cps sirens did. This effect, it was decided, may be caused by the type of acoustical



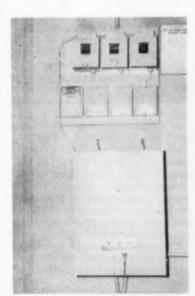
CIVIL DEFENSE warning system for Government Printing Office, Washington, D. C. is shown by this single line wiring diagram.

treatment used in most areas, and the spectrum of ambient noise of presses and other rotating machinery.

In order to determine the number and location of the sirens, the assistance of the Federal Civil Defense Administration was requested. A sound survey was first made with a sound level meter to determine the ambient decibel intensities through which the warning signals must penetrate. From these data, tentative locations for the sirens were selected. Subsequently, tests were made with sirens to confirm the selected locations. As a result, several locations were changed, and a few additional sirens added. It was determined that a total of about 50 sirens would be required, with the possibility that when the installation was completed, there might be certain small areas that would require special treatment. It was also considered possible that the saturation of the building with sound might make the removal or relocation of some sirens feasible.

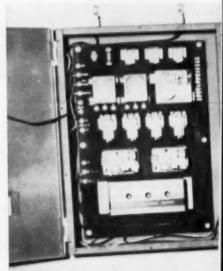
Alarm Control Panel

In order that the system would be placed in operation automatically when a warning is received on the Civil Defense "bell and light" signal, specifications were developed for an alarm control panel. Since the pulses received from the Civil Defense system are intermittent, and are not suitable for triggering sirens to produce either a continuous or wailing sound, the alarm control panel was designed to reproduce either the appropriate "evacuate" or "take cover" signal upon receipt of the first pulse on the Civil Defense "bell and light" system, and to continue the signal for three minutes for the "take cover" and five minutes for the "evacuate". In the event a second signal differing from the first should be received, this signal would take precedence over the first, and the sirens would operate accordingly.



ALARM CONTROL PANEL provides control and coding for Civil Defense warning impulses received over telephone lines. Telephone subsets and relays, and the "bell and light" warning system are above panel.

Provision was also made in the specifications for manual testing, and for manual initiation of any Civil Defense signal. Since the Civil Defense telephone "bell and light" system is tested once each week, provision was also made for manually silencing the alarm during these tests, if desired. This is accomplished through a non-locking, normally closed, pushbutton. In order to defeat the automatic sounding of the alarm system, an individ-



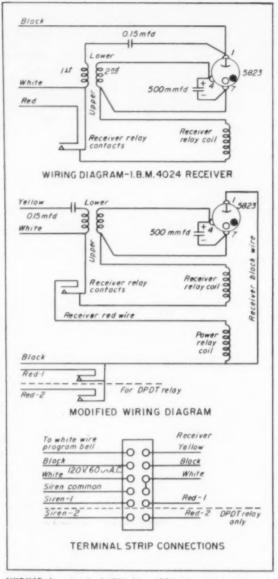
RELAYS and recycling timers which go into operation in this IBM control panel upon receipt of various impulses are shown in this interior view of panel. Manual control is also provided so that system can be tested weekly.



TRANSMITTER is IBM Type 611-4 model and of electronic high frequency type, shown here with isolating transformer and program bell panel.



INTERIOR view of transmitter, in which filaments are energized continuously for instant operation.



WIRING for standard IBM No. 4024 electronic receiver is modified as shown above to control operation of sirens.

ual will be required to depress the button continuously, or as long as an incoming signal is present. Upon its release, the panel will automatically revert to automatic operation. Thus, the system can never be left inoperative.

Power for Sirens

Several methods of furnishing power to the sirens located throughout the buildings and connecting them to the control panel were considered and investigated. These were:

1. Supplying power for siren

operation directly to the control panel, thence directly to the sirens throughout the buildings.

2. Supplying power to individual sirens, and controlling their operation from the alarm control panel by control wires and relays.

Supplying power to individual sirens, and controlling their operation electronically with carrier current.

To accomplish the installation by the first method would have required a power distribution system from the central control point to the location of each siren throughout the four buildings. The cost of such a distribution system would have exceeded the amount appropriated for Civil Defense.

The second method would have required the installation of control wires from the central alarm control panel to the location of each siren. Although this method would have shown some economies overthe first method, the cost of the conduit and control wire system would still have exceeded the funds available.

In order to avoid the high cost of a building wiring system, a wired radio or carrier frequency type of control was considered. The contemplated system would have superimposed a high frequency electric signal on the building electrical power distribution system. This high frequency signal would have then been available at every outlet and receptacle. The generator would have impressed a signal on a 120/208-volt distribution system carrying a load of approximately 6000 kva. Upon further investigation, however, it was determined that no high frequency generator of the capacity required to accomplish this had ever been constructed.

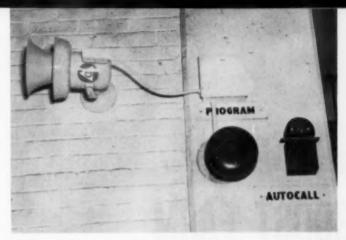
Carrier Current Control

Further consideration was then given to distributing the carrier signal over some other system. Two such systems were available. One was the autocall paging system, the other was the existing program bell system. Since the program bell system was available in all areas throughout all four buildings, it was selected for further study. It was determined that the smallest and most economical transmitter available would adequately energize the program bell system. It was therefore decided to make use of this method.

Equipment Installed

The equipment selected for the alarm control panel, for the control and coding function of the system. was IBM. This device will receive different impulses denoting an "evacuate" or "take cover" signal, or a silencing signal. Upon receipt of an "evacuate" or "take cover" warning impulse, appropriate recycling timers and relays go into operation. A continuous fiveminute signal is sent to a transmitter, causing it to oscillate for the entire period for an "evacuate" warning, and an interrupted signal of four seconds on, three seconds off for three minutes for "take cover". If either signal has been triggered, a second different signal will automatically cause the controller to immediately cancel the first and initiate the second for its appropriate time. Upon receipt of a "silence" signal, the output is immediately cancelled, and the control returns to a ready position to receive any future signal. All automatic functions are duplicated by manual control.

The transmitter is an IBM Type 611-4 four channel frequency gen-



SIREN and IBM electronic receiver are mounted adjacent to program bell. Carrier currents over program bell circuit control siren through receiver.

erator. This transmitter is designed to impress its signal on an energized power system. With only slight modification, however, its output may be coupled into a de-energized circuit such as the program bell system which was used. A change in rectifier tubes will permit continuous transmission of a signal for five minutes instead of intermittent operation.

In order to avoid the delay of warm-up time, the filaments of the transmitter are energized continuously. The transmitter is keyed by the controller (described above) to produce the signal desired, by a plate current relay. These features are all provided in the standard IBM model.

The transmitter was installed adjacent to the relay assembly which controls 12 program bell circuits. In order to isolate these circuits from the power system, a 1:1 ratio transformer is used on the 120-volt supply. The output of the signal generator is impressed between the isolated neutral of the program bell system and ground. Thus, wherever a bell circuit is available, the high frequency signal is present when measured to ground. The external connections of the various components are shown in the accompanying one-line diagram.

The receivers, one of which is required for each desired siren location, are IBM Type 4024. This receiver is designed to be connected to and receive information from a 120-volt power circuit. The high frequency signal information is impressed across one coil of a loosely coupled transformer. The voltage appearing on the secondary is used to control the firing of a cold cathode gaseous discharge tube. Cur-

rent flowing through this tube also flows through a small relay coil, the contacts of which open or close the power circuit of equipment to be controlled. This receiver was modified internally (see wiring diagram) to permit the insertion of the incoming signal apart from the power supply and by the addition of an auxiliary power relay. Both single and double pole relays are employed so that where two sirens may be economically energized from one receiver, this may be done.

With this installation, which is the first of its kind known, it has been demonstrated that great economies, in a Civil Defense or other signaling system, may be effected by the use of electronic signal generators and receivers. Where costly high power transmitters are required to energize a large capacity power system, it has also proven practical to utilize an existing signal system as the medium for transmitting the high frequency signal, and thus permit the use of the smallest, lowest priced transmitter available. The transmitter used at GPO also makes available 30 additional circuits for communication or control by the addition of economical auxiliary equipment.

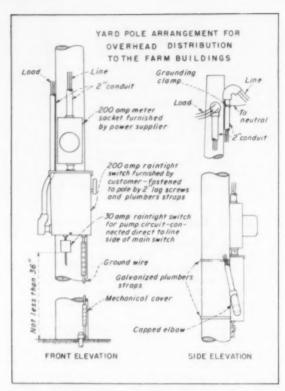
System Installation

Installation of all the equipment comprising this system was made by the Electrical Shop, Maintenance Division of the GPO, using qualified personnel as available.

Now that this Civil Defense warning system has been placed in service, it is earnestly hoped that, like liability insurance for automobiles, we will never be required to use it for its intended purpose.

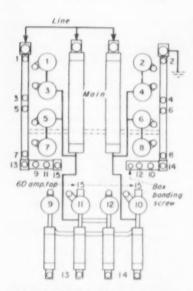
Bulk Milk Coolers

BOOST FARM ELECTRIC SERVICE NEEDS



TYPICAL 200-AMP yard-pole service arrangement for overhead distribution to farm buildings,

Minnesota contractors find door open to service replacement and upgraded wiring when farmers switch to bulk milk pickup and cooling.



BARN SERVICE PANEL recommended for rewiring combines 100-amp main pullout disconnect, one or more 240-volt pull-out disconnects and several plug circuits for lighting and general purpose outlets.

LECTRICAL contractors in Minnesota's rural areas are busy replacing farmstead electrical service equipment. Prime reason for this upsurge in farm rewiring is the gradual shift to tank-truck pickup of milk by an increasingly large number of milk plants. Instead of loading milk cans from roadside platforms, tank trucks now drive up to the farmer's milkhouse, plug in a truck-mounted electric motor and pump the bulk milk into the truck. Since the general pattern is an every-otherday pickup, farmers must have bulk milk storage and cooling facilities to meet milk production.

Size of a farmer's milk cooler tank can vary from 100 gallons (for a 10-cow herd) to 500 gallons (for a 60-cow herd) or more. Expected electrical demands can range from 1.1 kw to 3.3 kw depending upon tank size. Reported electrical consumption varies from 0.8 to 1.4 kwhr per 100 lbs of milk cooled.

Two distinct types of bulk tanks

are available: the direct expansion type and the ice bank type. Prime difference is in the cooling method used. The direct expansion type cools the milk directly with a refrigerant carried in coils or tubing at the bottom and side of the tank where it absorbs the heat as it vaporizes. This heat is dissipated through an air-cooled or watercooled condenser. The ice bank type stores up refrigerating capacity in a supply of ice and cools the milk by first pumping water over the ice and then over the outside of the bulk tank. Both require motors for the compressor, milk agitator, and a fan on the air-cooled condensers. The ice-bank type needs an additional water pump motor. On most expansion tanks, the compressor unit is remote mounted; on ice-bank tanks, it is generally self-contained. Heat from aircooled condensers must be exhausted from the milkhouse in the summer but can be used to help heat the room in the winter.



YARD POLE SERVICE of 200-amp capacity next to a Minnesota type pump house is a typical rural installation. Water pump circuit is fed from line side of main,



CLOSEUP of pole meter and disconnects showing service and feeder conduits. Small enclosure at left is a remote yard light control.



BULK MILK COOLER in milkhouse has fused disconnect switch on wall to serve rack-mounted refrigeration compressor (right) and tank agitator motor (left).

The power requirements of bulk milk coolers have a substantial bearing on the size of service equipment for the milk house or dairy barn. To this must be added the 20-amp "power outlet" for the electric milk pump on the pickup tank trucks.

Typical Service Installation

The actual amount of rewiring involved in bulk milk cooler installations can vary from one extreme to the other. In a few cases (where existing capacity is sufficient) the only requirements are new circuits from the barn service entrance equipment to the two new milkhouse outlets: one for the cooler and one for the power outlet. On a number of farms, the dairy barn service is too small. Then a heavier barn service entrance, service equipment, and feeder from the yard pole or main service center is necessary. If the farmstead main service is too small, this too must he changed.

Power use advisers in Minnesota are recommending 200-amp capacity for the farm yard pole or service center. Normally, this involves mounting a 200-amp disconnect switch with matching service conductors and conduit size to the meter pole. In some cases, a multiple pull-out type of disconnect is installed at the farm service center.

For the barn service entrance, where farmers are engaged in dairying, 100-amp service equipment with comparable feeder from the yard pole is being recommended. This supplies both the barn and an attached milkhouse. Usually a combination service cabinet is used embodying a 100-amp main pull-out fused disconnect, one or more 240-volt, 2-pole, pull-out

disconnects for heavy equipment circuits and several plug-fuse branches for lighting and general purpose outlets.

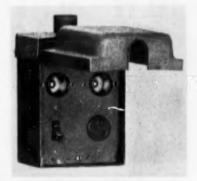
Of the two new milkhouse outlets necessary for a bulk milk cooler installation, one provides power to the cooler electrical equipment (compressor, agitator, condenser fan). Generally, a fused disconnect switch is installed for this purpose. The other outlet is for the use of the tank-truck driver. This is a weatherproof enclosure with a removable panel containing a 240-volt. 20-amp, 3-wire receptacle controlled by a 20-amp, 2-pole toggle switch and protected by two fuseholders containing Fustats and adapters. The cord from the milk pump on the tank truck is plugged into this outlet.

Cost of rewiring directly attributed to bulk milk cooler installations will vary. Where sufficient electrical capacity is already available in the milkhouse, the additional outlets and circuits have been installed for approximately \$50. Where heavier barn service entrance equipment and overhead feeders are needed, and a heavier farmstead main service is required, cost estimates vary from \$400 to \$500 or more.

To the alert electrical contractor, this "forced" upgrading of farmstead electric service capacity is an open door to promotion and serious discussion of better wiring throughout the farm premises. Both he and the farmer are beginning to see the farm as an agricultural production plant that can well use the benefits of an adequate wiring system. Even if no extensive branch rewiring is done at present, the farmer with a bulk milk cooler installation will have a heavier main service than before



POWER OUTLET in milkhouse (near window) provides switch-controlled, 20amp, 240-volt, 3-wire receptacle to plug in electric pump motor on tank-truck.



WEATHERPROOF OUTLET assembly for truck pump motor includes 3-wire, 20-amp, 240-volt receptacle, 2-pole switch and two fuses.

with possibility of spare capacity.

Thousands of these bulk milk cooler installations have been made in Minnesota. The net result is that the low-capacity, service-entrance bottleneck is being broken and the farmstead wiring adequacy program is gaining momentum.

distribution 30,4 w, 120/208 v, 60 N 4-500 MCM/leg 3 - 500 MCM neutral 2000 2000 2 2000 2000 2000 0 3 0.S/N Dressure switch 2000a bus 2-4 x 44"/phase 3-500 MCM neutral 10" deep. 15 "high

Commercial building modernizes with

NEW SERVICE FOR ADDED POWER

Flexibility with almost unlimited room for expansion is provided by extensive use of wireways to connect elements of service and distribution equipment.

THE new 200-amp service entrance, main distribution and metering equipment installed in the Harwood Building, Scarsdale, N. Y., indicates the improvement that can be made to existing inadequate installations to not only take care of increased present loads but to provide logically for anticipated future loads.

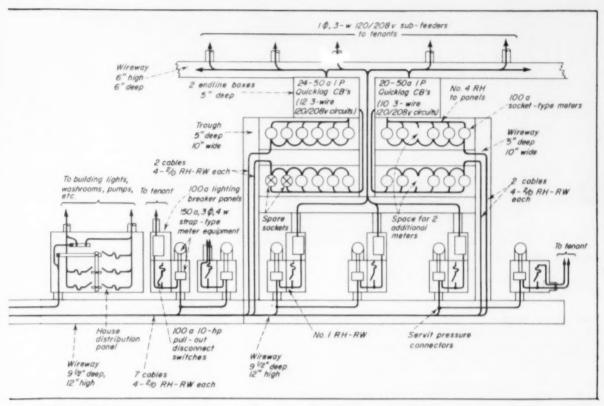
The problem facing William Fath, electrical contractor of Mount Vernon, N. Y., involved replacing existing 600-amp service facilities and the multiplicity of meters, conduits, fuse and switch cabinets, and overloaded circuits which had mushroomed to serve the

increased power usage of the 30 commercial tenants of the 30-year-old building. Several had installed room air conditioners; others were dissuaded until increased capacity could be provided. It was important to provide facilities for an anticipated 100% air conditioning load, with sufficient raceway, panels and cabinets in place to make future individual feeder installation a comparatively simple job.

The accompanying diagram and illustrations show the methods by which these objectives were accomplished.

Virtually all components of the new service entrance and associated equipment are connected by sheet-metal wireways with bolted, removable covers. Cabinets housing the 2000-amp main service switch and main distribution panel are mounted side by side on the wall of the service vault in the building's basement and are connected by a common gutter. Feeders to remaining equipment are carried by 91 by 12-in.-crosssection wireway through the wall to the adjacent meter room. All tenant meters and panels are mounted in this room and are accessible to the tenants if necessary.

The majority of the tenants (doctors, lawyers, etc.) are each



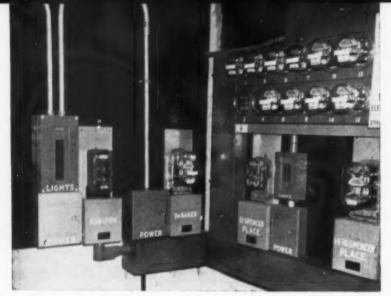
USE OF WIREWAY to connect service and distribution equipment is shown by simplified one-line diagram.

supplied by a single 50-amp, 120/ 208-volt, 3-wire, single phase circuit terminating in a plug fuse panel in the tenant's office, the circuits being metered individually by 100-amp, 3-wire, socket-type meters mounted in the meter room. These plug fuse panels are part of the old system, as are the risers. They will be replaced by new circuit breaker panels and risers at tenant expense as their increased requirements warrant. Main breaker panel facilities in the meter room are such as to make it possible to increase the present 50amp breakers to 100 amps if necessary.

The socket-type meters are mounted in four banks, each bank fed by four 2/0 RH-RW conductors. Spare sockets and meter housings have been provided to take care of future variations in number of tenants due to partitioning of tenant areas, etc. No cable taps were required in meter cabinets, the six meters in each bank being



METER ROOM components are lettered or numbered for easy identification. Lighting panels below meter banks have room for additional breakers; panels marked "power" contain individual 100-amp disconnects for present or future air conditioning loads; ample space remains on walls for future equipment.



WIREWAY turns corner of meter room wall to feed additional equipment, with plenty of room to grow. Service vault is on other side of end wall.

connected in parallel by looping from one meter to the next. Each of these four 4-conductor cables originates in a 200-amp, 3-pole fused knife switch in the main distribution panel.

The remaining three 200-amp switches in the main distribution panel feed six 150-amp, 3-phase, 4-wire, strap-type meter equipments serving major tenants having greater power requirements. Each of the three 4-wire, 4/0 RH-RW feeders from these switches

serves two meters, the required taps being made within the wireway by Servit pressure connectors, or "bugs". Each of these six tenants has been provided with a power disconnect switch adjacent to the meter equipment for serving air conditioning loads; lighting and appliance circuits are handled by a circuit-breaker panel either above the disconnect switch or in the tenant's area. The disconnects are rated at 100 amps, or 10 hp for air conditioning use.

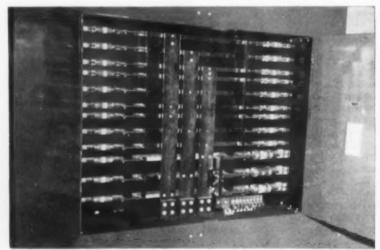
Two of these six major tenants are already using these disconnects to serve air conditioning loads. A doctor's offices have four window conditions in use totalling 3½ tons; a supermarket has a 5-ton central unit installed. The remaining disconnects are in place, ready for the new feeders when required.

Since for most tenants the existing risers were left in place, a method of conveniently connecting the old risers to the new meter equipment had to be devised. This was accomplished by installing a 6- by 6-in, wireway above the meter banks, into which sub-feeders from the 50-amp breakers were routed. From the wireway they were carried by rigid metal conduit to the old main distribution panel, which had been left in place. This panel was converted to a large junction box and no longer contains fuses. inside this panel the old risers are spliced to the connecting cable from the wireway. As new risers are contracted by the tenants, this distribution panel will be bypassed, the risers going directly to the 6 by 6 wireway.

Analysis of cable and switch capacities provided shows the extent to which "extra power" has been built into this installation, and the liberal amount of floor and wall space remaining in both the service vault and meter room will well handle any added distribution equipment required to put this power to use.



OLD CABINET which housed original main distribution panel is now used as large junction box. Old risers are spliced in this cabinet to extension cables.



MAIN DISTRIBUTION PANEL in service vault is connected to service switch (left) by means of two 4- by $\frac{1}{4}$ -in. busbars per phase plus three 500MCM cables for neutral, all enclosed by a 10- by 15-in, gutter which connects to wireway carrying feeder circuits through wall to meter room.



CONTRACTOR TIESO enjoying a promotional spin through St. Paul's residential area in his 1905 Buick roadster, Residents will be sure to remember his company name and telephone number.

HORSEPOWER **SELLS** HOUSEPOWER



CONTEST ADS appearing in local newspapers ask readers to identify car pictured; compare low horsepower with low housepower; invite request for free wiring checkup. Winners receive modest



LITHOGRAPHED HOT PADS comprise the contest prizes. A set of 6, with Tieso ad on back, are sent to each of the first 25 correct entries received. One contest is held each month.

... for Tieso Electric Co., in St. Paul, Minn. Unique antique car contest focuses public attention on low housepower; pays off with wiring leads and jobs.

arly this year, homeowners were amazed to see a fur-clad, derbycapped gentleman laboriously chugging his way around St. Paul's residential byways in a 1905 Buick roadster. Now and then he would glance enviously at the modern cars parked in front of the homes. A placard on the roadster asked all who looked if their home wiring was as antique as this car and reminded them that low horsepower and low housepower were practically the same.

This rather forlorn motorist was none other than Art Tieso, energetic head of Tieso Electric Co., launching his one-man Housepower and Live Better Electrically campaign. The obvious theme: You can't keep pace with modern times with a low horsepower car; neither can you keep pace with modern living with low housepower wiring in

Following this rather dramatic opening gun, showman Tieso developed an "antique car contest" with entry-blank ads running in the St. Paul Dispatch or Pioneer Press. Each ad carries a picture of an antique car for the contestant to identify; a bold-face type admonition that "Modern Living Demands Modern Wiring"; offers a free home wiring checkup, if so noted on the entry; and has space for name and address. The first 25 entries correctly identifying the car receive a set of six beautifully

lithographed hot pads depicting various antique cars.

Contestants requesting a home wiring checkup receive an immediate follow-up call from the Tieso organization. Other names are directed to a prospect file for future follow-up.

The first two contests (one per month) brought in a total 265 returns with 32 requests for a home wiring checkup. Of these, eight Houspower jobs totaling some \$2,-250 have resulted so far. A third contest produced some 58 returns with ten wiring checkup requests. Added business volume has yet to be totaled.

The initial response to his campaign has been so encouraging that Mr. Tieso believes he can substantially increase his sales by continuing the contest for the balance of 1957. And there is always this to be considered: Once the seed of discontent with existing low-housepower wiring has been planted, many "undecided" homeowners will want better electrical convenience. When that happens, the name they should remember is Tieso Electric.

To make sure they don't forget, the old 1905 Buick will be on the streets again as the Minnesota winter subsides. As Art Tieso puts it, "The car is ready to go with full horsepower (though low) to produce more Housepower sales for our organization."

MAINTENANCE PROCEDURES

. . . related to power system components

(Part I)

Preventive maintenance, long-approved as a practical policy for preserving productive machinery, must also include specific components of the electrical distribution system if industrial operations are to remain continuous. Transformers, as key items of these systems, should receive primary consideration.

By Henry E. Heddesheimer, Consultant on Electrical Engineering
Plant Engineering and Maintenance Service, General Electric Co., Schenectady, N. Y.

MORT of major catastrophies. nothing disrupts productionline manufacturing operations more completely than power outages, and these outages do not have to be of a "total plant" utility-outage variety, either. Even an insignificant feeder fault can seriously disrupt production coordinations, secondary effects being experienced in departments "along the line" even days after the fault has been cleared. For example, in a plant that manufactures power transformers, a minor power failure in the woodworking section might halt production of cable supports for only a few hours, provided no fire or explosion damage was incurred. After the fault has been located and repaired, however, the assembly section might have to "stand by" (with plenty of cores, coils and tanks on hand) until the flow of cable supports again resumed its intended pace. In like manner, all subsequent sections might be affected at later dates, and they would remain affected until coordination of all productive departments was again restored. This illustrates the fact that even "minor" outages can have "snowball" effects, and several such outages might easily alter the profit picture of a small-margin concern.

Requirements for power continuity are not limited to factory operations, however, for modern offices likewise have become dependent upon electrical continuity for lighting, air conditioning, comptometers and even their modern typewriters. Power shutdowns mean operational shutdowns as well and, even after restoration of power, a prolonged "settling down" period usually follows.

Since modern plants are becoming increasingly motorized, "automated" and electrically complex, and since investment in modern machines and tools are constantly increasing, reasonable returns can be obtained only if equipment is operated at rated speed or full capacity continuously. Therefore power continuity is a must, for, as a large automatic machine tool builder put it, "We must assume that our power supply is continuous, for we already have enough problems making mechanical parts of our machines function properly". This ever-increasing dependence upon electrical equipment and power supply emphasizes one thing: the importance of preventive mainte-

Components of the distribution system should merit as much consideration as components of a production set-up, and maintenance routines for electrical and mechanical equipment alike should warrant the establishment of practical inspection and records. Even components inherently requiring little attention should not be entirely neglected, for, as indicated above, minor items can result in major shut-downs, long production interruptions and costly repairs.

Transformers

Inherently, transformers are trouble-free pieces of equipment, designed for years of reliable service. For this reason they are often taken for granted, neglected and omitted from a maintenance schedule. This, quite obviously, is false economy.

First; let us consider small indoor open dry-type transformers used extensively in industrial plants.

Initiate your preventive maintenance program for these transformers by making a survey of all installations in your plant to be sure none are so located that they are subject to wetting from open windows, leaking steam lines, condensation from overhead cold water lines, etc. Also be sure that all installations allow for free circulation of air around and through the transformer.

Under normal use the open dry type transformer should have an internal inspection once a year. Deenergize the circuit and inspect the unit internally for dust and dirt accumulation, loose connections, discoloration due to overheating, and corrosion.

The windings should be cleaned preferably by a vacuum hose; however, compressed air may be used providing it is reasonably dry and not in excess of 25 psi. If the dust accumulation is small, or the transformer is in a location where it is inconvenient or impossible to use a vacuum hose, the windings may be wiped with a dry cloth. Use of a solvent should be done with care and with a thorough knowledge of the solvent used, since some solvents might be harmful to the insulation and have a deteriorating action. If the transformer inspected has been de-energized for a period of time, say overnight or longer, inspection should be made to insure that obvious or visible condensation has not accumulated on windings.

Make periodic checks of the load and voltage to insure that you are not operating over capacity. This information should be recorded so that, over a period of time, any trends will be obvious and remedial action can be taken before an out-

Second; consider the larger transformers in the plant.

The load, voltage, temperature and coolant level of liquid-filled main-substation and load-center transformers should be checked frequently and recorded. In some plants this is done every week, others once a month, which in most cases is quite sufficient. However, if it is known that the transformer is operating at full load or overload due to an emergency condition, checks on temperature, etc., as frequently as every hour, might not be unreasonable.

When servicing your liquidcooled transformers, in addition to
checking load, voltage, etc. as previously mentioned, a yearly check
should be made on the coolant condition and ground connections;
check for condensation on the
underside of the manhole or handhole covers and make a general
check for bolt and connections
tightness, and leaks. If you have
a water-cooled unit, check for scale
in the heat exchanger which, if



TEMPERATURE, voltage, load and coolant level of a large liquid-filled transformer should be checked and recorded at frequent intervals. In the above illustration, the author (left) discusses the reasons for making these checks with one of GE's power-station electrical maintenance men.



SAMPLING VALVE located at bottom of transformer tank permits drawing small quantity of coolant for analysis. Bottle is stoppered promptly and securely, then taken to laboratory for tests pertaining to acidity, turbidity and dielectric strength of the coolant.

allowed to build up appreciably, will cause the transformer to operate at higher-than-normal temperature and consequently shorten its life.

To check the condition of the coolant, draw a sample from the sampling valve located at the bottom of the tank. Wipe the valve clean and run off some liquid before taking the sample, rinse the sample bottle several times with the liquid being sampled, and be sure the

liquid is as warm or warmer than the surrounding air to prevent condensation and consequent contamination of the sample. Stopper the sample tightly and take it to your lab or power company for dielectric, acidity, and turbidity tests. Poor test results usually indicate the necessity of removing moisture and other contaminants by filtration. It is a very rare case, except after many years of service, that the coolant will have to be replaced.

HOME FIRE ALARMS

... an Aid to Residential Rewiring

Installation of reliable, inexpensive fire warning systems for the home provides personal contact between contractor and homeowner which can lead to extensive electrical modernization work.

RESIDENTIAL fire alarm systems—aside from their indisputable function of saving lives and preserving property—can be of substantial help to the electrical contractor as a "door-opener" to subsequent electrical modernization work.

A complete fire warning system made by a reliable manufacturer can be provided at a cost to the homeowner which compares favorably with many other home improvement products and materials currently enjoying tremendous sales, with the invaluable added

sales advantage that it can very easily be instrumental in averting a tragedy. At the same time, it affords the electrical contractor who is desirous of building a volume of residential rewiring work an opportunity to examine the home's electrical system and make recommendations to the prospective customer. It follows that a homeowner who recognizes the value and advisability of providing fire alarm protection for his family can be counted among those most likely to give serious thought to wiring inadequacies, up-to-date lighting, and electrical appliance conveniences when they are pointed out on the spot during installation of the fire alarm equipment.

Basically, the most important function of the residential fire alarm system is to awaken sleeping occupants as soon as possible after the outbreak of a fire—when visual discovery or detection by the smell of smoke are most unlikely. Anticipated action following the alarm is hasty evacuation of the premises by all occupants, followed by immediate notification of the local fire fighting agency and subsequent extinguishing of the blaze.

The essential components, then, for the average home are a sufficient number of thermostatic devices to detect the rise in temperature accompanying the fire, and an audible signal to sound the alarm. Additional components, such as annunciator-type area indicators, outside weatherproof alarms, etc., may be used as desired.

Location of the detectors and the

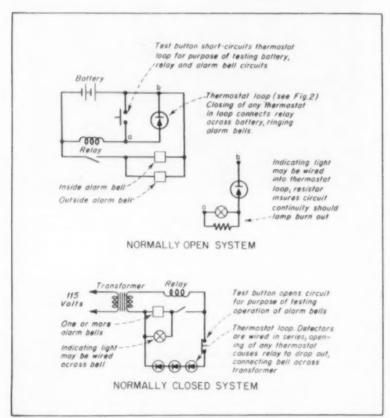


FIG. 1. Typical normally open and normally closed systems.

audible alarm is important. Since hot gases generated by a fire rise, they will collect in the highest available spot they can reach. As the fire continues to burn, this level of superheated air descends. When it reaches sleeping occupants, they are overcome by asphyxiation, usually without awakening. Or, the air may reach its flash point and "explode", spreading flames throughout the house.

Two considerations, then, govern, the placing of the detectors to insure the sounding of an alarm as quickly as possible: (1) They should be placed at or near the ceiling, where they will sense the first hot, rising air. (Detectors are available which operate either around 135-140F for most locations or around 175-190F for normally warm places such as furnace rooms or attics.) (2) They should be located where, under abnormal conditions, a fire would be most likely to originate.

One or more detectors placed in the peak of the attic roof would respond to an unusual temperature rise, regardless of the origin within the house, as well as affording protection should a conflagration break out in the attic itself due to spontaneous combustion, sparks from the chimney, or lightning. However, since infiltration of air to the attic space may often be hampered by fire stops in the walls or by tight insulation or vapor barriers over the ceiling, it is advisable to locate another detector in the ceiling of the upstairs central hall or passage connecting the bedrooms. Additional protection is provided by detectors on the basement ceiling near the furnace, in the kitchen ceiling near the range or other frequently used cooking appliances, over the laundry or ironing area, in the ceiling near the fireplace, over the television set, or in any storage space where spontaneous combustion may occur. (Since even one detector is considerably more valuable than no detectors, the number installed can be a flexible means of adjusting the total cost to the amount the homeowner is willing to invest in the system.)

The audible alarm should be placed in or immediately outside the bedroom so as to be in the most advantageous position to awaken sleeping occupants. Units placed close to panelboards to reduce line voltage wiring or so located to insure minimum length of detector

SINGLE LOOP: Any thermostat will close circuit and operate relay , however, a break in the line will render all detectors beyond the break useless. Length of line is limited, since excessive resistance may prevent relay from operating MULTIPLE SINGLE LOOPS Any number of single loops may be connected in parallel to service separated areas Length of each loop is limited as with single loop Indicator lamp may be wired in series with each loop as illustrated in Fig.1. DOUBLE LOOP: All thermostats will operate relay, even with breaks in one or both sides of line, since there are two return paths. Also, twice as much wire may be used as with single loop, since(as long as there is no break! equal resistances are connected in parallel This is the preferred system NORMALLY OPEN LOOP VARIATIONS

FIG. 2. Variations in thermostat loop circuits for normally open system. Letters "a" and "b" represent corresponding points in normally open circuit of Fig. 1.

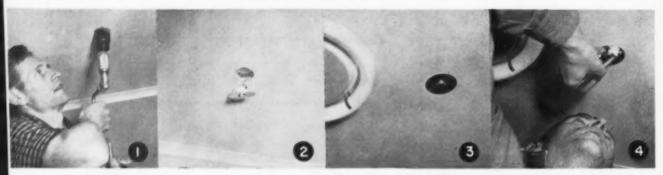
circuits may give a false feeling of security and actually fail to awaken the residents.

In general, two circuit arrangements are used to wire the detectors: the normally open, and the normally closed circuit. Typical diagrams illustrating the two methods are shown in Fig. 1. The normally open system is probably the simpler of the two. The detectors are connected in parallel, as ordinary lamps, and the closing of a detector is equivalent to the closing of the familiar light switch. This system takes no current except when an alarm is sounded. However, a break in the line could go undetected if regular and frequent tests were not made.

The normally closed circuit requires only a single-conductor loop,



ALARM BELL of normally open system hides battery and relay, is mounted un-obrusively on wall of hall between bedrooms. Easily accessible test button is located beyond lower edge of gong.



INSTALLATION of detectors in ceiling is simple and rapid. (1) Opening is cut in ceiling with brace and circular drill; (2) wire is brought through hole from above and connected to detector; (3) glue is applied to rear of aluminum ring and the entire assembly pressed in place; (4) aluminum ring is painted to match ceiling. Detectors such as these provide protection for an area of approximately 400 sq. ft.

the detectors being wired in series. A current of a few mils flows constantly; thus a break in the line would set off an alarm.

Detectors available may be either self-restoring or non-restoring. The former may be operated repeatedly without requiring replacement. One method of testing the operation of the circuit using this type of detector is to hold a lighted match in the vicinity of the detector. It will operate in a matter of seconds. This thermostat usually consists of two snap-action gold contacts, either normally open or normally closed, in a dust-tight enclosure. The non-restoring type, usually used on normally closed systems, consists of two contacts soldered together against a spring action. The solder melts when the critical design temperature is reached, and the contacts spring apart, opening the circuit. The detector must then be replaced.

Energy Source

The circuits may be fed by the house current through a signal transformer, or by a battery. Closed-circuit systems would present a constant drain on the battery; however, where utility power interruptions occur occasionally, a correctly maintained battery system will be the more reliable. Whether the system is normally open or closed, a battery must be checked occasionally, since its shelf life will eventually be exceeded. A common procedure is to replace the battery once a year.

Systems operating on house current are likely to be more costly, due to inclusion of a transformer and the 115-volt wiring required to feed the transformer. Also, to insure maximum reliability, the circuit should not in addition feed other outlets, since fuses blown due to trouble on other equipment would cause interruptions of fire protection. More elaborate equipment is also available which incorporates a transfer switch to shift to battery operation in the event of power failure.

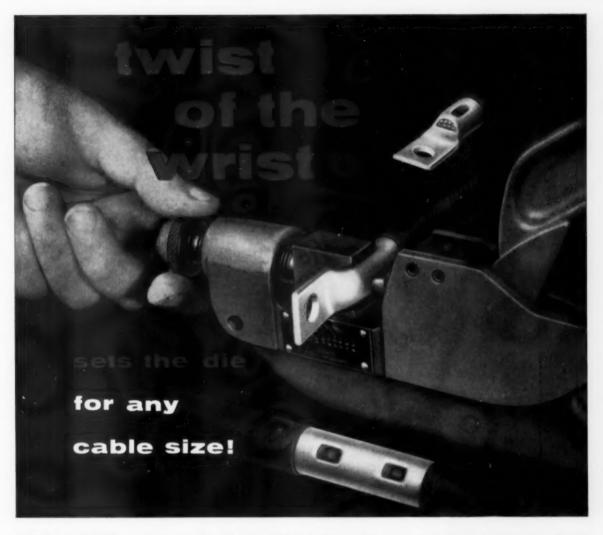
In the last analysis, the energy source which is considered to be the most reliable for the particular installation should be adopted.

Installation of a complete system is relatively simple and is a matter of a few hours for the experienced electrician, depending upon the number of detectors involved. In single-floor homes with an attic space, detectors may be put in place in the ceiling from above, with wiring stapled to ceiling joists. Multi-level constructions will require some fishing between floors.

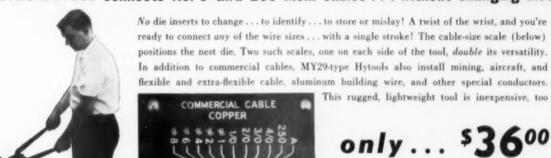
From a volume-of-sales standpoint, it is important to keep the installation as simple and free of "extras" as possible. Sales abuses in the past by unscrupulous individuals using inflated prices and unnecessary frills fostered public distrust of the product as a whole and were responsible for the withdrawal of funds by the FHA for fire detection systems. The simple components described above can be installed quickly and at a very nominal cost, making outside financing unnecessary. Use of established manufacturers' products results in customer satisfaction and a willingness to listen to ideas on further electrical improvements.



OUTDOOR BELL, inconspicuous yet easily heard by neighbors and passersby, serves to bring instant help in case of fire. By pressing test button inside the house, this bell may also be used to drive away prowlers.



MY29 HYTOOL connects No. 8 thru 250 Mcm cables . . . without changing dies!



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Practical Methods

Flange and Saddle Supports for Wire-Armored Feeders

CABLE INSTALLATION

Two practical installation ideas, both related to the support of high-capacity wire-armored cables, come from the design boards of the Keystone Engineering Corp., Philadelphia. The first is a method for securing vertical risers from a single point near the upper terminal, and the second is a method for preventing cables from creeping around a cradle or supporting saddle.

As indicated by the accompanying diagram, cable armor is peeled back at the upper support point and the separate strands are clamped between the flanges of an OZ type FS assembly. Strands assume reverse bends in this process and, as flange bolts are tightened down, cable armor is securely and uniformly secured on all sides. Flange supports, in turn, rest upon a steel bearing plate which is spot welded to two I-beam cross-beams, then to a second (lower) bearing plate that rests directly upon structural steel members. Holes sufficiently large to contain the armored cables are cut in both bearing plates to permit free and easy passage of the cables.

In the particular installation illustrated, two such primary risers upwards in concretesheathed fiber conduits from a basement service entrance) are supported at floor-slab level of an upper-floor load-center substation. As noted, fiber conduits (including a third, spare duct) are terminated at this point, with short now-unarmored sections of cable protected and segregated in a sectionalized box having metal barriers between each of the three compartments, and having removable front and side panels to permit inspection.

As further indicated by the shaded upper sections of cable, armor is resumed as cables rise from this floor-level sectionalized box to continue upwards to vault ceiling, then reverse direction across a saddle in order to make a top entrance to primary switchgear cubicles.

In crossing this ceiling-high saddle, the second practical installation method is adopted, for armored cables were placed in position in still-wet plaster. As the plaster set, each separate strand of armor is firmly embedded in a series of rigid ridges that prevent the cables from creeping, slipping or sliding around the cradle. The basic supporting cradle beneath the plaster consists of expanded steel mesh, so ample bearing strength is provided by this ingenious installation technique.

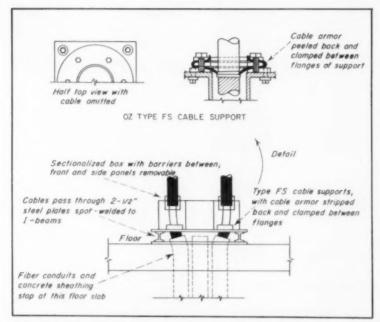
Office Modernization With Surface Ductwork

MODERNIZATION

Renovating electrical facilities in existing office structures is often a challenging engineering experience, since the designer faces many problems that are automatically eliminated in new construction. Generally, new facilities must provide maximum flexibility yet blend with interior decorative treatments; cost must be kept within reasonable bounds and much of the installation work must be accomplished while routine activities are carried on by office occupants. Various aspects of these problems were encountered by Chief Engineer R. J. J. Tennant when he recently revamped the electrical system in Pittsburgh's Henry W. Oliver Building to accommodate air-conditioning units for about half (600) of the tenants. Units are console-type combination air conditioners and unit heaters, rated at 120 volts for 1-ton capacities.

Since the building was erected prior to the advent of underfloor distribution networks or the trend towards year-'round air conditioning, the management decided to provide wiring facilities that were easily expandable, thereby accommodating the presently-desired 600 units and also providing for an additional 600 units when and if they are demanded.

Ample space existed for additional conduit risers, so distribution expansion took the form of central panels, with more than six miles of NEP 24- by-12-in. steel Surfaceduct fitted to inside corner walls, extended across ceilings and mounted above baseboards of exterior walls to serve the air conditioning units. A separate circuit

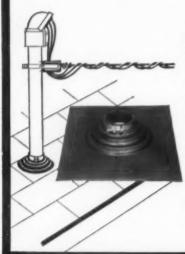


SEPARATE STRANDS of cable armor are snubbed between flanges of annular support which in turn is supported by twin steel bearing plates and I-beams. Unarmored sections of feeders are protected and segregated by barrier box. Armored cable is used for long vertical runs where protection against physical damage and strength for support of feeder is required.

SYNROFLASHING ELIMINATES

MAST VIBRATION..ROOF LEAKAGE

AT THE POINT OF PENETRATION



Blackhawk's new neoprene roof flashing unit absorbs mast vibration before it reaches the point of roof penetration. Notice the step-down collar area. These collar steps "give" slightly. This action is what absorbs any mast vibration. The base does not move. The mast can't work loose, damage shingles and give moisture a place to seep in.

Synroflashing is weather proof and weather resistant. Exposure to hot sun, rain, sleet, salt spray, ozone or other corrosive atmospheres won't cause it to crack, peel or rot. A special collar clamp makes it weather tight.

To install the unit, simply slip it over the pipe and push it down to the roof. Shingles fit over it easily. Synroflashing units are available for 2" and 2½" pipe.

Another outstanding feature of the Blackhawk service entrance mast is the slip-fitter entrance head. Easy to install . . . saves time. Just slip it over the conduit and tighten two set screws. No threads to cut, no extra clamping devices. Blackhawk service entrance heads are available in 2" and 2½" slip fit units with 1½" service entrance cap. UL approved. Pat. Pending.





Blackhawk's sturdy pipe mounting brackets attach to vertical studding of the house. Supports the entire service drop strain. Eliminates weight and pull from rafters and roof.

Blackhawk service entrance masts, with slip-fitter head and new Synroflashing, can be sold as a complete kit or as separate fittings.

Specify BI when you buy from electrical wholesaler



BLACKHAWK INDUSTRIES

DUBUQUE, IOWA



SURFACEDUCT mounted along top of baseboard and painted to blend with background provides additional electrical service for offices in old building, in this case serving to provide power for 3/4-ton console-type combination air conditioning and unit heater located adjacent to outside window. This installation already accommodates 600 such units and will serve 600 more when the complete building adopts year-'round air conditioning.



PANEL BOX, surfaceduct riser to ceiling level, thence to outer walls and down to baseboard level constituted the major part of this office-modernization program. Since ample space existed in riser shafts for additional feeders to panel boxes, this detail did not involve any special routing problems. More than six miles of steel ductwork were installed to supply air conditioning units.

was installed in each duct run and, at present, five units are served from each run. Finished raceway was painted to blend with background colors.

Economy of installation was achieved because ducts could be mounted quickly, and full utilization of the "lay-in" principle of wiring could be applied if required. Other benefits to be considered concerned the system's flexibility, for the removable capping of the raceway permits easy access to wiring for replacement, rerouting or tapping-in of branch circuits.

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PLM Catalog 301 lists and illustrates fittings for all types of installations to 15 kv, to meet standard as well as special requirements. Listed also are PLM Splicing and Terminating Kits to speed up the job . . insure complete, correct materials for every armored cable splice and termination, as well as for splices in non-metallic and lead-covered cable. Ask for your copy.





PLM PRODUCTS, INC. - 3875 West 150th Street - Cleveland 11, Ohio WIRE AND CABLE FITTINGS AND ACCESSORIES



MOBILE HAND SAW is a familiar piece of time-saving power equipment on installation projects of Continental Electrical Construction Co., Chicago. Front legs of base stand are equipped with rubber-tired wheels so unit can be moved easily to work areas. Here, mechanic cuts end sections of metal underfloor duct to fit specific layout. Unit is also used for conduit, channel iron, angle iron and other metal cutting chores.

800 MA Fluorescents Light High Bay Area

IGHTING

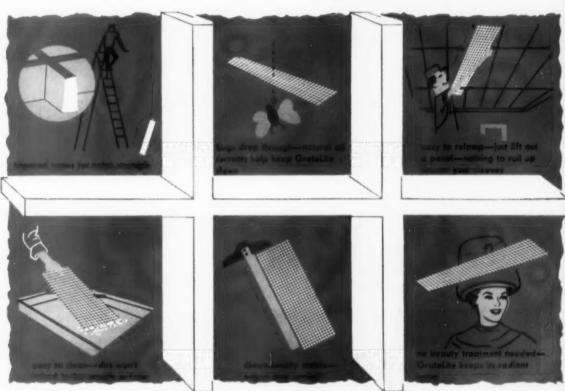
Continuous row industrial reflector units, using two 96T12 fluorescent lamps per 8-ft reflector, have been used to light a 41,600 sq ft high bay area of the Bath Iron Works, Bath, Maine. The installation consists of 20 rows of luminaires, nine reflectors per row, so that each 2-lamp 8-ft long reflector unit lights an area of 231 sq ft. The resulting illumination intensity is 28 footcandles average. The rapid-start, cool white slimline lamps operate at 800 ma, from two-2-lamp 277-volt ballasts, with a power input of 230 watts per ballast. Thus the system provides 28 footcandles per watt per so ft, with the reflectors installed 50 ft above the floor.

This high bay area is 520 ft long, and 80 ft wide. The continuous rows, each 72 ft long, run normal to the length of the building, and are spaced 26 ft apart. Total ceiling height is 55 ft, with reflectors installed 5 ft below the ceiling, but above the crane rails.

The reflector equipment is Smithcraft type ALS2-96-800 ma, which provides 19% upward component of light, and lights the fibreboard finished ceiling uniformly, which is painted two coats of flat white paint. Thus no brightness "hot spots" exist. The reflectors are very wide, 16½ in., with lamps



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500-watt incandescent lamps in Abolite GBF Protecto Shields

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The self-cleaning action of Abolite lighting fixtures makes them ideal for high bay installations, where maintenance is difficult and costly. All high bay fixtures developed by Abolite have either slotted-necks or open-top designs. Air circulation through these openings keeps the reflector surface swept clean, reduces lamp operating temperatures. Lighting efficiency remains high. Replacement costs are lower because cooler lamps last longer.

Abolite has a complete line of high bay fixtures, including RLM-approved Alzak aluminum and porcelain enamel types for use with all kinds of mercury and incandescent lamps. For full details, write Abolite Lighting Division, The Jones Metal Products Co., West Lafayette, Ohio.







FLUORESCENT 800-mg cool white lamps. powered from 277-volt system, and installed in Smithcraft ALS factory lighting units, 50 ft above the floor, provide 28 footcandles of highly comfortable illumination in this 41,600 sq ft high bay area of the Bath Iron Works, Bath,

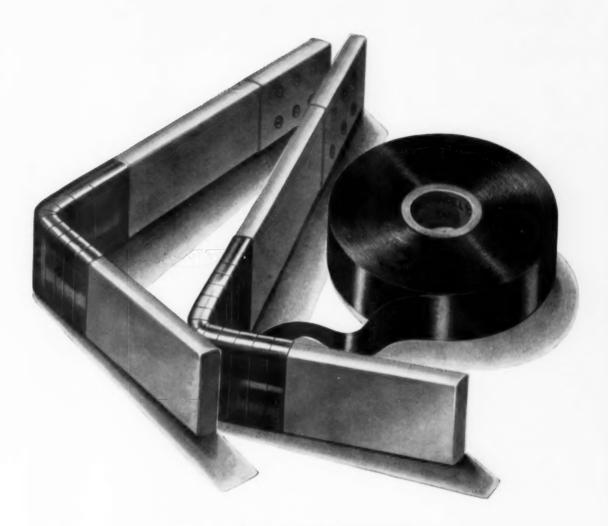
spaced 8 in. apart, and provide 30degree crosswise shielding. As a result, there is a high ratio of reflector area per lamp, the lamps are mounted well away from the reflectors for better low brightness comfort, and a high overall efficiency of 87% results.

Reflector equipment is supported by Kindorf, with Bulldog Universal trolley ducts attached to the Kindorf. The reflectors are then powered from the trolley ducts.

Expanded Metal Cable Troughs Solve Problems Related to Space, Weight and Cost

DISTRIBUTION

A. B. Klyne, city electrician for Dover, Ohio, and John McCue of the electrical contracting firm of William C. Kammerer & Associates, recently cooperated in designing a distribution system related to the installation of a new 7500-kw generator for the Dover Electric System. First they were faced with a space problem, for although plenty of space was available for the generator itself, there was practically none below it to permit normal methods to be applied for the distribution of six 2000MCM 5000-volt cables to the city system. Conduit was ruled out because of mechanical difficulties which would have been involved with such an installation. And, had a totally enclosed



whatever the job . . .

PERMACEL TAPE

PERMACEL | EPAGE'S | products | Permacel Tape Corporation, New Brunswick, N. J. . a Johnson Johnson company



FIG. 1—Vertical run consists of two 24-in, troughs mounted back-to-back. Cables so protected and supported are lashed to troughs every 3 ft with marlin. Note clamp connections between troughs and grounding cables extending down riser shaft.

system been adopted, reduced current-carrying capacities of cables would have in turn resulted in still larger cables, conduits and installation problems. A rigid, rugged supporting system was necessary, however, because the weight of the cables to be carried approximated 9 pounds a running foot. Finally they settled on expanded metal cable trough, which proved completely satisfactory.

As indicated in the accompanying illustrations, trough installations were both extensive and varied in nature. For example, as indicated in Fig. 1, two 24-in. troughs were placed back-to-back to support 18 single-conductor 500MCM risers, this vertical run carrying cables into the distribution system. Use of trough permitted access to cables, voltage regulators, bypass disconnects and load-break switches. Cables were lashed in this vertical run every 3 ft with marlin. As further indicated, trough and channel supporting members for disconnect switches are securely connected to grounding cables by bolts.

Another application was related to cables connected to a 5000/6250-kva transformer (viewed from above, Fig. 2). This outdoor installation, 11 ft above the ground, reduced the cost of support to about a third of other methods considered. In this instance cables carried were 4000-volt 1000MCMs (right) and 2400-volt 2000MCMs (left). Cables are single conductor varnished cambric insulated PVC jacketed.

Still another application supported neutral breaker and reactor

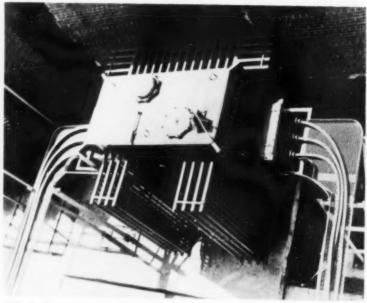


FIG. 2—Tie transformer viewed from above shows use of Cope troughs to support cables 11 ft above ground in this outdoor installation. All cables so supported are single conductor varnished cambric PVC Jacketed feeders.

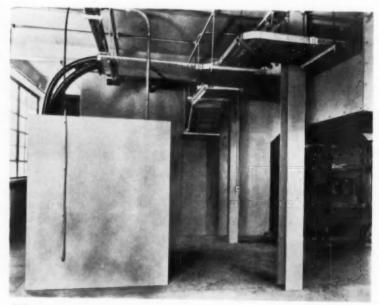


FIG. 3—Neutral breaker and reactor leads for new Dover Municipal Light & Power generator are supported by trapeze hangers, channel struts and expanded metal cable troughs. Control cables are carried separately in narrow trough at upper left.

leads for the new 7500-kw generator (Fig. 3), with control cables being carried in a separate narrow trough running above reactor leads and at right angles to them (upper left of photo). These generator neutral breaker and reactor leads were supported by a combination of trapeze hangers, channel struts and expanded metal cable troughs.

According to both Klyne and McCue, use of expanded metal cable trough solved these various installation problems quite satisfactorily; reducing costs, weight and installation time while maintaining high current-carrying capacities and ready access to cables in the distribution system. Troughs selected were manufactured by Cope.

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saving minimum.

need, and the contractor to install it in jig time. Factory wiring and assembly are so complete that on-the-job work is reduced to a cost-

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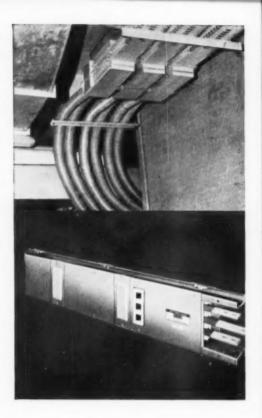
THE "EXPRESS" BUS FOR POWER DISTRIBUTION

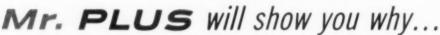
Simple to install, safe to wire, economical to use

This installation tells immediately one Westinghouse bus duct story. Power is quickly accessible everywhere.

And Westinghouse bus duct is safe. Westinghouse design makes it impossible to come in contact with bus bars when they are hot. The low-impedance feature insures maximum power delivery on runs such as you see here or even longer.

To get the rest of the story, you should consult your MR. PLUS or a Westinghouse sales engineer. Ask for Bulletin B-5835A.





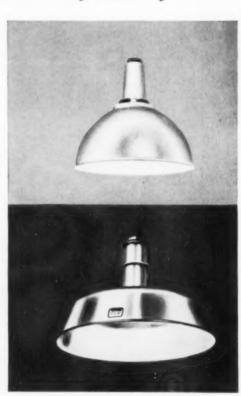


LIGHT IT RIGHT WITH WESTINGHOUSE

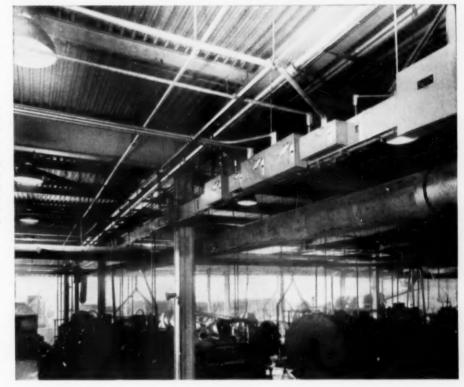
Because of carefully engineered design, there are Westinghouse fixtures to help you get the right light on every industrial situation. Right from the standpoint of proper levels of illumination for safety and efficient working conditions. Right from the maintenance man's viewpoint: less work for his crew, less overhead charged against his department. Right also in long-range cost... installation, maintenance, and ratio of light-per-watt expense in operation.

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Patented lock-in feature of this Westinghouse fixture makes lampchanging or cleaning a simple matter. Highly efficient level of illumination. Ask your distributor salesman for a "Blue Bag" demonstration.

Write or ask your dealer for Westinghouse bulletins detailing the type of lighting you need.

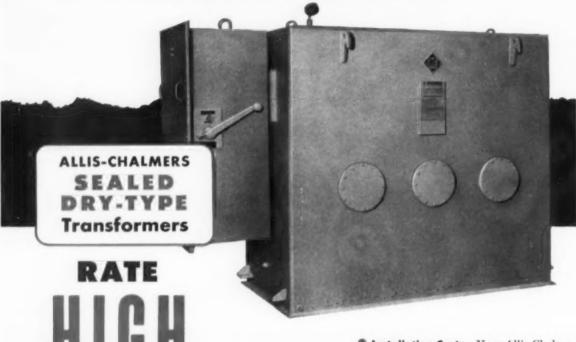
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"What type transformer do you prefer for plant service, station auxiliary and load-center applications?" Sealed dry-type units rated number one in five basic categories of operation and operational cost. For all the facts, see your Allis-Chalmers representative or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.



with Operators
...ON EVERY COUNT

	Sealed Dry Type	Open Dry Type	Askarel Filled	Oil Filled
INSTALLATION COST	1	3	2	4
LOCATION VERSATILITY	1	2	3	4
SAFETY	1	3	2	4
RELIABILITY	1	2	1	1
MAINTENANCE	1	3	2	2

- Installation Costs—Your Allis-Chalmers sealed dry-type transformer is ready to be energized immediately upon shipment, or may be stored indefinitely until needed.
- Location Versatility It can be located indoors or outdoors, overhead or underground in flood areas, dirty and contaminated atmospheres no special precautions need be taken.
- Safety No fire or explosion hazard. Transformer unit is hermetically sealed in inert dry nitrogen gas.
- Reliability—Performance is unparalleled. Contaminants and moisture cannot enter case to affect service. Oxidation of insulation materials cannot take place.
- Maintenance Upkeep is virtually eliminated. No liquids to maintain. No need for periodic cleanout of core and coil. Plain tank shell is easy to paint.

Types rated in order of Preference

ALLIS-CHALMERS

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NEW PRODUCTS CATALOGS, BULLETINS ADVERTISEMENTS

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PRODUCT NEWS, PRODUCT BRIEFS:

Use first line of boxes, insert item numbers of products on which more information is desired.

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Product News



Surface Raceway

A new metal surface raceway, called Twinduct, is designed to carry both high and low potential conductors in a single run. Engineered into Twinduct are all of the features pioneered and proved in Surfaceduct, a 2 by 2 surface raceway designed to service loads falling within the range of No. 6 AWG conductors. The principal difference between the two products is that Twinduct offers two separate 2 by 2 raceways with a single screw-on cover. It incorporates the lay-in principle of wiring. Covers are available to adapt to any manufacturer's approved outlet devices up to 20-amp capacity. Twinduct is finished in a satiny gray and is manufactured in 10-ft lengths with 1 and 1-in, knockouts and mounting holes on 15-in. centers in the base. Bridges are furnished with each 10-ft section. The combined twin-raceway's overall measurement is 14 in. deep by 41 in.

National Electric Products Corp., Gateway Center, Pittsburgh, Pa.

Lighting Fixture (2)

A new Steberlite for PAR-64, 500-watt sealed beam lamp is available. Unit is constructed of cast aluminum with heat radiating fins for dissipation of heat and cool operation. Unit is equipped with weatherproof universal joint and built-in aiming clip. Mounting arm is threaded \(\frac{1}{4} \) in. and furnished with locknut, A variation is available with \(\frac{1}{2} \) in. inside thread in mounting arm and includes \(\frac{1}{2} \) in. threaded nipple to permit installation on aluminum fittings having \(\frac{1}{2} \) in. threaded openings, A second varia-

tion is provided with weathertight connector to accommodate No. 16/2 or No. 16/3 cable. A special group of fittings with $\frac{\pi}{4}$ in. tapped openings is available including a parapet mounting flange.

Steber Manufacturing Co., Broadview, Ill.

Entrance Heads

Two new sizes of aluminum "Dual-Grip" service entrance heads have been added to this line. They are $2\frac{1}{2}$ and 3 in. Cast of high strength aluminum alloy, they eliminate threading of conduit, provide weather protection, and are universal in application. The clamptype entrance heads are now available from $\frac{1}{2}$ through 3 in.

J. A. Weaver Company, 2110 Howard St., St. Louis, Mo.



Exit Lights

A new series of triangular exit lights designed for wall or ceiling mounting. They feature removable wiring compartments with two 25watt porcelain sockets which can be wired together on one circuit or individually on separate circuits. Housings are constructed of heavy steel, welded electrically, and frames are of heavy, die-cast noncorrosive alloy with concealed hinges on face for easy maintenance. Lights are available in a standard finish of gloss gray baked enamel for frame and housing, or colors of coral, chocolate brown, green, black or oyster. Satin chrome or brass finishes are available for frames only. Literature is available.

Prescolite Manufacturing Corp., 2229 Fourth St., Berkeley, Calif.



Fitting

(3)

(5)

A new vertical tee fitting to provide continuous metallic contact between vertical and horizontal runs of cable trough. Fitting permits the cables to be continuously pretected when they are changed from a horizontal to a vertical run and when in the same run other cables continue in the horizontal section. Cables from a vertical run can be dropped in either direction into horizontal runs.

T. J. Cope, Inc., Third & Walnut Sts., Collegeville, Pa.



Lighting Units

(6)

New OV-10 luminaires enable mercury-vapor lamps to be used for residential zone street lighting. They produce a narrow, high candle power distribution that is well suited to the wide pole spacing and narrow streets of residential districts. The unit allows mercury lamps to be operated with the arc tube in the horizontal position thereby enabling efficient use of mercury lamps and better optical control. The OV-10 accepts L-H4, A-H22, or C-H5 clear mercury lamps

Westinghouse Electric Corp., P.O. Box 2099, Pittsburgh 30, Pa.



ANNOUNCES NEW PACKAGE DESIGN

You know our present package. We hope you'll come to know our new one better. We believe it's another step forward in merchandising our products.

Midwest Electric Mlg. Company

MANUFACTURERS OF ELECTRICAL WIRING PRODUCTS
1639 W. WALNUT STREET

Chicago 12, Minois



Lighting Fixture

A new extra shallow 3½-in. depth recessed downlight, designed to accommodate up to 150-watt lamp, for installation in either poured concrete or plaster ceilings. Weather-tight construction including 16 gauge galvanized back box, neoprene gasketing and opal tapered glass. For use in shower rooms, canopies, sidewalks and corridors in public buildings. Unit has been designed for exterior and interior locations where severe weather and corrosive conditions prevail.

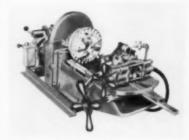
McPhilben Manufacturing Co., Inc., 1329 Willoughby Ave., Brooklyn 37, N. Y.



Panelboards

New 200-amp "E-Z-Red" panelboards designed to accommodate "E-Z-Red" circuit breakers, 15- to 50-amp double pole or single pole and 15- and 20-amp switching neutral. The amperage rating for the main lugs, are 200 and 210. They are available in either 3-wire or 3-phase 4-wire, 28 to 42 individual circuit controls. Interior assembly is attached to an easy removable self-aligning mounting plate. Line terminal block is attached to mounting plate. Bus bar and lugs are silvered. Cabinets are built of galvanized steel and supplied with easy removable knockouts. Wiring gutters are 4 in. at top, bottom and sides. Cabinet is reversible type, line lugs may be at top or bottom. Door trim and dead front are removable type. Door trim can be had in either flush or surface and is equipped with a flush spring lock and two keys. Finished in baked blue-gray enamel.

Wadsworth Electric Mfg. Co., Inc., Covington, Ky.



Pipe and Bolt Machine (5

The weight of this heavy-duty Model-A pipe and bolt machine has been reduced to 260 pounds, by using special aluminum alloy castings. Unit threads 2-in. pipe in 15 seconds. It has rack and pinion feed, and right-hand, lathe-like operation. Monto-type, duo-type, and Quadra-type die heads are available with high-speed steel dies. Motors are 110/115 or 220/330-volt, 25/60 cycle Universal; or 220/440, 3-phase, 60 cycle.

Beaver Pipe Tools, Inc., Warren, Ohio



Gearmotor (10)

This line of gearmotors has been redesigned to assure customers' top efficiency in all slow-speed power applications. Designed to meet the user's specific needs, the gearmotors are available with polyphase, single phase and dc motors, with a variety of mounting positions possible, including downshaft and tilted shaft. Also, they can be obtained in open drip-proof, dust-proof, explosion-proof, and totally enclosed frames.

Century Electric Co., 1806 Pine St., St. Louis 3, Mo.

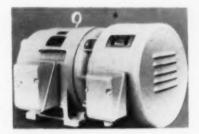


Truck Bodies

(11)

New utility truck bodies specially designed for electrical contractors and service organizations. These bodies are especially adapted to the transportation and field utilization of motors, pulleys, V-belts, conduit, wire, BX cable, switch panels, pipe vise, ladders, cable reels, floodlights, lighting fixtures, rubber goods, climbers, belts, testing equipment and small parts and tools of all types. Available models include utility and panel bodies with canopy tops, in chassis sizes from 1 to 11 tons. All bodies are constructed of heavy gauge steel welded into one integral unit, with completely watertight doors, reinforced tailboards and complete undercoating. Variable compartment and shelving arrangements provides large storage and load areas.

Reading Body Works, Inc., Reading, Pa.

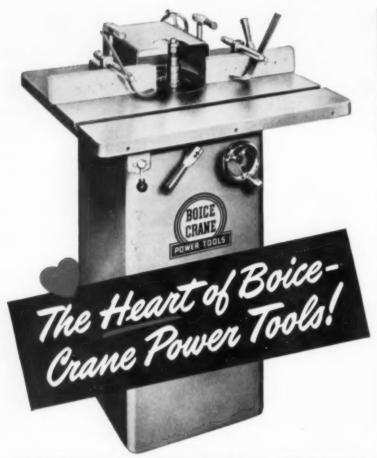


Converter

(12)

A newly developed "Nobrush", brushless 400 cycle converter, operating from standard 60 cycle supply. Unit employs 40-pole brushless generator, direct coupled to 1200 rpm, 60 cycle synchronous motor. Generator is direct mounted on motor, making unit two-bearing. Inertia of motor rotor and flywheel construction of generator rotor, give substantial flywheel effect. Any standard voltage, single or 3-phase, can be supplied. Three-phase machines can be loaded asymmetrically. Units available with ratings from 1 kva to 10 kva.

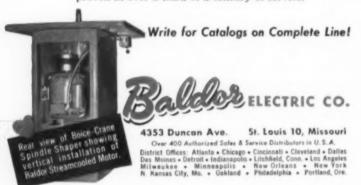
Georator Corp., Manassas, Va.



BALDOR STREAMCOOLED MOTORS

For years famous Boice-Crane Power Tools have enjoyed a reputation for faultless performance. And for years, like hundreds of other leading manufacturers, Boice-Crane has specified and depended on Baldor Streamcooled Motors to maintain its enviable prestige.

This remarkable reputation for motors of uncompromising quality, is why Baldor consistently delivers out-of-the-ordinary performance under the most rugged conditions—a performance record proven in over a third of a century of service.



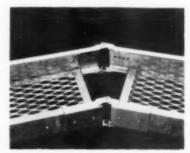


Switches

(13)

A new line of 20-amp rotary lock switches with P. & F. Corbin pin tumbler locks, are available in single pole quad break; actually a double pole switch shunted across both ends for single pole applications. These 20-amp, 125-volt switches are designed for use in industrial plants. theaters. auditoriums. schools, hospitals, institutions or any building where it is necessary to prevent unauthorized tampering with lights. Included in this line are weatherproof switches with flush plates and screw caps, especially suitable for switch control in locations exposed to dampness and other atmospheric conditions.

Arrow-Hart & Hegeman Electric Co., Hartford, Conn.



Adjustable Elbow

(14)

A new adjustable elbow fitting has been added to P-W cable support systems. Adjustment can be made in either direction up to 90°. It provides flexibility in getting around obstructions such as pipes, columns, structural members. Ideal for jobs requiring constant changes in direction such as in tunnels, tanks, spherical shapes, etc. New adjustable riser fitting offers similar advantages to meet various changes in elevation.

P-W Industries, Inc., Duncan & Melrose Sts., Philadelphia, Pa.



*John E. Artopoeus of Artopoeus-Smith Company, Northern Ohio representatives, one of Smithcraft's nationwide sales engineer organization.



Smithcraft fluorescent lighting units are installed in thousands of stores, schools, offices and diversified interiors from coast to coast. Wherever good lighting is important, you'll find . . .

SMITHCRAFT "America's Finest Fluorescent Lighting"

He's a man who knows lighting from "installation" to "illumination". And because "installation" is responsible for a good part of your profit, your Smithcraft sales-engineer is ready to work with you to make sure that every feature designed by Smithcraft to speed and simplify installation is thoroughly understood and utilized. Why not talk to your man from Smithcraft and take advantage of his ability and experience . . . you'll find it both informative — and profitable!

...the troffer by Smitheraft

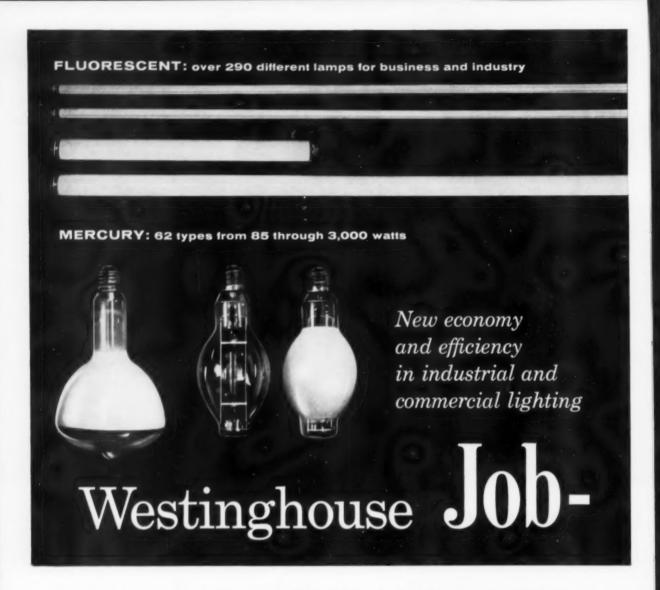
As an electrical contractor, you know there's a lot more to recessed lighting than "light"! Installation is what you're interested in, and the Smithcraft patented Yoke-Aligner Hanger is typical of the attention that Smithcraft has given this problem. Because of this development, Smithcraft Troffers can be installed in far less time than usually allotted — no precise measuring is required — levelling can be accomplished by simple screwdriver adjustment before or after installation is completed! You can sum it up by saying "you make more profit on Smithcraft Troffer installations." Ask the man from Smithcraft!

Smitheraft - "AMERICA'S FINEST FLUORESCENT LIGHTING"

PLEASE ATTACH TO YOUR BUSINESS LETTERHEAD and mail to

Smitheraft LIGHTING,	CHELSEA 50, MASS.	ů
NAME	and the same of th	
TITLE	CO.	
ADDRESS	CITY	STATE
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□ Please send me the "TROFFER HANDBOOK":
 □ Please send me the complete SMITHCRAFT CATALOG, containing data on America's Finest Fluorescent Equipment.



Now you can have exactly the right kind of lamp in exactly the right size for every individual lighting job

Westinghouse again demonstrates its leadership in lighting with lamps Job-Tailored to cut costs, reduce accidents, improve both "See-Ability" and morale. All this is possible because Westinghouse produces more than 10,000 kinds of lamps with exclusive developments like those below which give you more for your lighting investment.

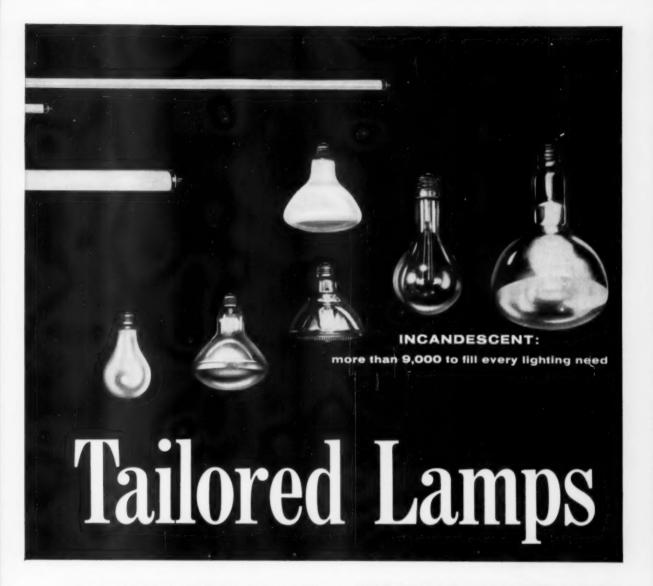
Fluorescent Lamps, for example, have a new highintensity phosphor—*Ultralume*^{**}—which gives more lumens per watt plus uniform end-to-end light for the life of the lamp.

Mercury Lamps with special "hard" glass Weather Duty™ construction. Can't be harmed by snow, rain,

condensation—even without protective coverings.

Incandescent Lamps provide an extra measure of quality with exclusive *Lifeline Filament*™—made possible because only Westinghouse controls the manufacture of filaments from tungsten ore to finished wire.

In addition, Job-Tailored lamps give you more light from existing fixtures. By standardizing on bases, bulb sizes and light center lengths, Westinghouse provides a high degree of lamp interchangeability. As a result, with many Westinghouse lamps, you may increase light output to more efficient working and safety levels without changing fixtures.



FREE WESTINGHOUSE JOB-TAILORED LIGHTING SURVEY SHOWS YOU HOW TO GET THE MOST FOR YOUR LIGHTING DOLLAR. To enable you to spot places in your present lighting installations where incorrect lamps may be costing you money, call in a Westinghouse Lamp Representative. With your plant engineer or maintenance supervisor, he will inspect your lighting installation, make a careful analysis of his findings, and report his recommendations. To get this free service, simply fill out the coupon. You'll be dollars ahead with Westinghouse JOB-TAILORED lighting.

Westinghouse

WESTINGHOUSE	ELECTRIC	CORPORATION
LAMP DIVISION		

Industrial-Commercial Lighting Service Bloomfield, New Jersey

Please have your Lamp Representative in my area make an appointment with our Mr.

to arrange a survey of our lighting needs.

NAM

COMPANY

ADDRES

ZONE ___STATE

FULL NAME OF PLANT ENGINEER

PHONE NUMBER.

I am interested in [incandescent

fluorescent mercury lighting.





Interiors for Load Centers (15)

Spring mounted interiors which can be snapped in or out in seconds and which provide automatic front alignment even when a flush load center box is installed off plumb are now available on circuit breaker load centers. With the interior removed, the whole inside of the load center box is free for hammering or screwing the box to a stud. There is also more room for pulling wires and installing cable connectors. Circuit breaker load centers with "snap-out" interiors are available in ratings from 70 through 200 amps, with flush or surface fronts, and from 4 to 30 circuits. They are manufactured in general purpose NEMA Type 1 or raintight NEMA Type 3 R enclosures.

General Electric Co., Circuit Protective Devices Dept., Plainville, Conn.

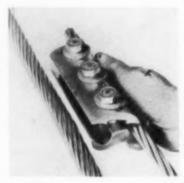


Switch (16

A new momentary-contact switch, No. 100, which has a normal life under pilot load in excess of 20 million cycles. Rating of the new normally "off" switch is 15 amps, 125 or 250 volts, 1 hp, 120 or 240 volts ac. The dc rating is 1 amp, 125 volts; ½ amp, 250 volts. It is for such applications as clothes dryers,

outboard motors, clothes washers, vending machines, floor polishers, punch presses and other industrial machinery, where it may be used either as an actuating or safety-limit switch. It is offered in four models, all vibration and dustproof in their molded phenolic cases and all designed for easy installation: screw terminals, soldering lugs, speed connectors and wire leads.

McGill Manufacturing Co., Electrical Div., Valparaiso, Ind.



Clamps (17

A new line of clamps, known as 489 Series, can be applied without being disassembled. A newly-developed universal parallel groove design makes it possible for three clamps to cover the full range from No. 2 to 397.5 MCM in ACSR and from No. 2 to 400 MCM in stranded aluminum conductor. Top and bottom parts of clamps are solid aluminum alloy extrusions.

Aluminum Company of America, 1501 Alcoa Bldg., Pittsburgh 19, Pa.



The Surfex method of electrical surface wiring is for such structures as farm buildings, vacation cottages and other housing where hidden wiring is not deemed necessary. The Surfex method is designed for easy installation, all connections made directly to the base. Surfex devices allow for installation of any number of outlets in barns, milk houses and poultry houses. Adequate wiring in these buildings permits the farmer to take full advantage of all modern electrical equipment available, in addition to convenient switch-controlled lighting. Approved by UL, the devices are made of porcelain, and will not corrode.

Pass & Seymour, Inc., Syracuse, N. Y.



Air Circuit Breakers

(19)

High interrupting capacity, enclosed molded case air circuit breakers in NEMA IV, VII and IX enclosures are available in the Cordon-type. Providing fault protection up to 100,000 rms amps, the units combine the design and operating features of molded case circuit breakers with current limiting Chase Shawmut Amp-Traps in one unit. Low magnitude fault conditions are cleared through breaker without affecting Amp-Traps. At higher magnitude, the Amp-Traps assume fault clearing in less than 1 cycle and limit short circuit current to a fraction of peak available value.

Hope Electrical Products Co., Inc., 24 Long Ave., Hillside, N. J.



Wireway and Fittings (20)

Wire can be assembled and laid in after the wireway is installed, with Boss lay-in electrical wireway and fittings. Three sizes of lay-in wireway are available in the new line: 2½- by 2½-in., 4- by 4-in., 6- by 6-in. Lengths of 1, 2 and 5 ft are included. Flangeless units are equipped with knockouts and full length hinged covers. Sections are designed so that they can be clamped together by a U-connector, or can be attached to flanged wireway by using an adapter. The line offers a selection of accessory fittings: U-connectors, 45 and 90 degree elbows, T fitting pull boxes, closing plates, etc. UL approved, equipment is finished in gray baked

Huenofeld Company, 2702 Spring Grove Ave., Cincinnati 25, Ohio

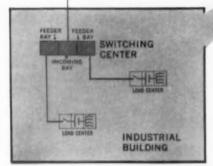
FOR INDUSTRIAL HIGH-VOLTAGE POWER CIRCUITS-

in your switchgear-buy S&C Metalclad Switchgear-Save 50%

Industrial circuits do not have transient faults. They cannot be re-energized immediately after an outage.

Hence costly circuit breakers are unnecessary. S&C Power Fuses give the <u>right</u> protection.

HIGH VOLTAGE POWER



A typical industrial high-voltage distribution system. The darkened area represents the functional position of such a switching center as shown above in the Squibb installation.



The new switching center for the E. R. Squibb and Sons Antibiotic Laboratory and Manufacturing Plant at New Brunswick, N. J.—a division of Olin-Mathieson

For industrial high-voltage power circuits, conductors run in cables or conduits. They are not exposed to lightning, falling trees, rodents, wind, or ice which typically cause transient faults.

Consequently, the only faults that occur are permanent faults and S&C Power Fuses give the right protection against them.

The quick reclosing feature of expensive circuit breakers is of no value here.

S&C Metalclad Switchgear—by using S&C Power Fuses rather than circuit breakers, and by incorporating load interrupters for full load switching—brings substantial savings in switchgear costs—sometimes as much as 50%.



Specialists in High-Voltage Circuit Interruption for Utilities Since 1910

S&C ELECTRIC COMPANY

POWER FUSES - DISTRIBUTION CUTOUTS AND FUSE LINKS - LOAD INTERRUPTERS - METALCLAD SWITCHGEAR

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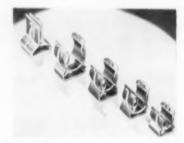


Rolls are twice the usual width, double the bearing surface on conduit—sure straight start of cut... by hand or power drive—extra fast and easy. Pays you to see it before you buy your next cutter—at your Supply House.

No. 201, 1/4" to 11/4" No. 202, 1/4" to 2"

The Ridge Tool Company, Elyria, Ohio, U.S.A.





Fuse Clips

(21)

A new line of wire-reinforced fuse clips and jaws that withstand excessive vibration and shock. Clips are available in 30-amp 250- and 600-volt; 60-amp 250- and 600-volt, and 100-amp 250-volt.

Ilsco Corp., Cincinnati 27, Ohio



Industrial Fixture

122

An all-new, 8-ft industrial fixture for power-groove fluorescent lamps features Alzak aluminum reflector to control lamp brightness. It is expected that the new IP 2501-08 unit will find wide use for general lighting in industry, especially at mounting heights in the 20- to 35-ft range. A continuous opening in the top permits light to go upward to the ceiling thus reducing brightness contrasts.

The Miller Company, Meriden, Conn.

Transformer

(23)

A new smaller, lighter 3-phase distribution transformer available in ratings 150 kva and smaller, 15 kv and below. Representing an average reduction of 13 in. in height and 22% in weight of former design, the transformer has a three-legged wound core. Low losses and low exciting current are features. Transformer is available in either conventional or self-protecting designs.

Allis - Chalmers Manufacturing Co., Milwaukee 1, Wis. more enjoyable outdoor living begins here...

New KILLARK

Weatherproof Flush Switch
FITTINGS



Snap-Tite Cover

Always tightly closed by spring action, when not in use. Double-lip design plus gasket eliminate water entrance.

Alumalloy Body

Won't ever rust or stain. Sturdy, streamlined design with flat back for easy mounting anywhere.

Large Inside Working Area

Plenty of finger room for easier, faster wiring.

Designed for modern outdoor living, the new Killark Weatherproof die cast fittings offer good looks . . . lasting protection . . . ease of installation — and cost no more than ordinary fittings. See your local Killark distributor for all the facts.



Alumalet - A fitting name to remember.

ELECTRIC MANUFACTURING COMPANY

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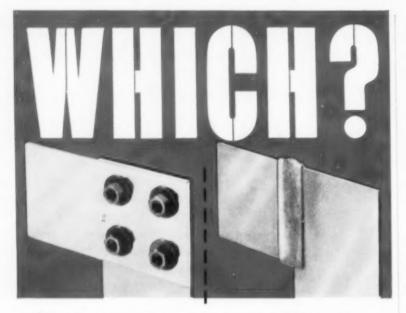
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Philadelphia 2014 Chancellor St.
Pittsburgh 4830 McKnight Road
San Francisco 714 Harrison St.
Seattle 4130 First Ave., So.

New York 600 W. 181st St.

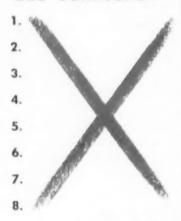
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When it comes to connecting bus, single or multiple—CADWELD Electrical Connections have no equal. GET THE BEST... GET CADWELD.

BOLTED bus connection



CADWELD® bus connection

- CADWELD is a BUTT connection — no waste in material. On 6" x 6" x ¼" Ell connection save 3 lbs. of copper.
- 2. No Drilling.
- 3. No Tinning.
- 4. Lower Cost.
- 5. No Wasted Space.
- 6. Cannot Loosen.
- 7. Cannot Corrode.
- 8. No Maintenance.

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Erico Products, Inc.

2070 E. 61st Place

Cleveland 3, Ohlo

IN CANADA: ERICO INCORPORATED, 3571 Dundas St., West, Toronto 9, Ontario

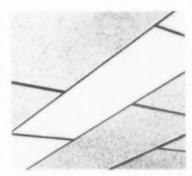


Switchboard Line

(24)

A new standardized 14-in, deep switchboard line that is completely front accessible, is designated as Series 1 "Power-Style switchboard. It is available for services from 400 to 2000 amps. A variety of service sections with standard current transformer compartments for power company use is available. either in hot or cold sequence with a main breaker or main switch. Where local code permits, these service sections can be supplied with up to six breakers or switches without a main disconnect. Distribution sections, incorporating molded case circuit breakers, QMB switches or Saflex switches, are connected either by cable or by standard horizontal bus. This bus is designed to permit future connection of switchboard sections as power needs expand. Switchboards can be fed either by cable or bus duct. Manual is available,

Square D Company, 6060 Rivard St., Detroit 11, Mich.



Troffer Unit

(25

The lay-in 2 Gridex Troffer is a 1-ft wide fluorescent unit specially designed to provide flexible recessed lighting for inverted 1-ft "T" grid-type suspended ceilings having interlocked tees. It integrates architecturally with any interior design and is available with hinged steel louvers or with shield-

"SLATER'S CLICKING!"

"More and more electrical contractors ask me for Slater wiring devices. Sales are jumping because this quality line of rugged devices performs dependably and is priced right. Slater's new colorful package and displays help, too. My customers buy Slater with confidence."

- - · appliance switches · lampholders
 - · power outlets · receptacles
 - switches weatherproof devices
 - wall plates automatic kloz-a-lite

QUALITY WIRING DEVICES

Write Dept. S-10 for descriptive catalog.

SLATER ELECTRIC & MFG. CO., INC

SAY SLATER WITH CONFIDENCE







MAINLINER LUMINAIRES SAVING INSTALLATION COSTS 3 WAYS!

Westinghouse has now created a line of completely new and radically improved-type luminaires for interior lighting!

They are named the Mainliner Luminaires—incorporating every desirable feature discovered and every important advancement made in luminaire design and construction, throughout the past 10 years!

As a result, these Mainliner Luminaires produce substantial savings—of costly installation time and expense—in three distinctly definite ways!

Mainliner Luminaires are completely modular—coming in exactly 1-foot, 2-foot and 4-foot widths—and 2-foot, 4-foot and 8-foot lengths. This makes it easy to plan their application—enables workers to "figure" and "lay out" each job right! The first time! Every time!

Mainliner Luminaires are dimensionally correct!
This makes them "mate" exactly with any type

whatsoever of "squared" ceiling material—and eliminates the usual "wedging", "pinching" and misalignment that frequently require "over-all compensation" and time-consuming delays!

Then, each Mainliner Luminaire housing comes complete—pre-assembled and wired!—all ready for immediate installation! Doors and shields, too, are pre-assembled—for quick hanging! Saves up to 30% of installers' time!

In addition, Mainliner units are specially reinforced—making them rigid, easier to "handle", much faster to mount! Their extreme "shallowness" helps avoid plenum chamber difficulties. Combination knockouts are located everywhere required, And "wrap-around wireways" and "either-end" lead wires save hours of electricians' time!

Mainliner Luminaires will help you, too, to beat installation estimates!



Exceptional Variety and Advanced Design Simplify Application!

Helps to increase Contractors Modernization Sales!

Mainliner Luminaires—in 6 different sizes, 4 mounting types and 13 selected shieldings—permit a tremendous number of striking and appealing, new, modern ceiling designs!

This already is making Mainliner Luminaires, favorite, for example in retail-store modernization. And every progressive retailer knows how vital good lighting is—if his store is to compete!

Some retailers emphasize the use of light to identify strongly, or to distinguish their stores. Some say, "The cash value of good lighting can actually be measured by the increased store-traffic that better lighting brings!"

Others insist on adequate lighting as... "The mainstay of display"! One more group considers that lighting should be... "Top on the list of store fixtures, essential in order to secure repeat business"!

This is the <u>significant</u> "sales information" for enterprising contractors. And contractor after contractor already has reported... "selling retail-store modernization is <u>easier</u> when I start by recommending Mainliner Luminaires"!



YOU CAN BE SURE ... IF IT'S Westinghouse





DO YOU KNOW WHY??

The only "electrically sound" system; let us explain ... or...ask your cable manufacturers representative.

ALSO... Send for your copy of the story of

"CABLE IN-FREE-AIR"

AVAILABLE THROUGH LEADING CABLE MANUFACTURERS

PRODUCTS, INC.

5300 VINE STREET, CINCINNATI 17, OHIO

ing in hinged door frame. With steel louvers, the unit provides a shielding of 40° by 40°. Louvers are hinged on patented Duo-Cam hangers and may be opened or closed from either side. Troffer is also available with all types of glass and plastic shielding in the hinged door frame, which feature pressurecatch. Units are available in 4-ft lengths for two and three rapidstart Bi-Pin lamps. They can be installed individually or in contin-

Smitheraft Lighting, Chelsea 50,



Floodlighting Units

(26)

Two new series of weatherproof wiring troughs and splice boxes are designed to increase floodlighting efficiency in outdoor applications. Both are made of aluminum alloys, Covers are precision cast aluminum and are made full length to expose the entire box or trough interior for easy splicing. Trough holes are standard 1-in. NPS to fit any standard lampholder or fitting, and are slanted outward to provide additional space for more lampholders on each trough. Wiring troughs come in sizes from 9 in. to 22 in. in length, to hold up to 12 lampholders individually, while the new splice boxes come in square, round, and hexagon shapes, all available with locking set screws at each hole to permanently fix floodlighting focus once set. All are UL-approved. Interchangeable accessories include pole top slip fittings for 1-, 11, 2-, 21- and 3-in. pipe, and wall brackets for mounting complete floodlighting assembly units. Clusters can be "tailormade" with the many standard interchangeable lampholders.

Stonco Electric Products Co., 333 Monroe Ave., Kenilworth, N. J.











GROUNDING OUTLETS



DUPLEX OUTLETS



TURNLOK



POLARIZED



DESPARD LINE

a complete line of wiring devices of the Highest Character

save time on the whole job ...

FAST, EASY WIRING WITH PRESSURE TERMINALS

There's real easy wiring ahead when you specify the P&S 1501 Switch and the P&S 1500 Duplex Specification Type Outlet, both with time-saving pressure terminals. Wires are locked in automatically, held by strong phosphor bronze springs, cannot loosen due to vibration. The outlet has double torsional contacts that give "long line" contact with minimum heat. Both devices mean a quicker, easier, more profitable operation on every residential job!



For full information on these and other high-quality P&S devices, write Dept. ECM-27.



SEYMOUR, INC.

YRACUSE NEW YORK

MAKE THE COMPLETE JOB COMPLETELY P&S





Circuit Breakers

New Tri - Pac circuit breakers contain a modified AB breaker and a current limiting fuse with three tripping elements; time-delay thermal, instantaneous magnetic, and current-limiting fusible. Breaker can be quickly reset after breaking on overload or usual fault current. Tripping cause, whether overload, usual fault or extreme fault, is indicated upon resetting of breaker. Fuse testing is eliminated by plungers in special fuses that tell which phase or phases are in trouble. Breakers are now available in three frames in NEMA standard ratings of 100, 225 and 400 amps, 2- or 3-pole, Ratings of 600 and 800 amps are to follow. Interrupting capacity at 250 volts dc and 600 volts ac is 100,000-rms amps.

Westinghouse Electric Corp., P.O. Box 2099, Pittsburgh 30, Pa.



Transformers

(28)

A new series of totally sealed, dry-type distribution transformers for outdoor or indoor installations. This series covers ratings of 5 kva. 7½ kva and 10 kva, single phase 60 cycle; 9 kva and 15 kva 3-phase 60 cycle in all standard voltages of 600 and below. By using Class H insulation throughout construction, size and weight per kva have been re-

See your industrial, hardware or electrical supplier

ARRO EXPANSION BOLT COMPANY

1540 Boone Ave., Marion, Ohio



SLICK INSIDE TOUGH OUTSIDE

for superior fishing...permanent zinc protection

XDUCT RIGID STEEL CONDUIT listed by UNDERWRITERS' LABORATORIES, INC.



National Electric Products

PITTSBURGH, PA.

2 Plants * 12 Warehouses * 41 Sales Offices

duced. Unit can be mounted with three bolts to beams, columns or walls. Large wiring compartment and knockouts on sides, back and bottom together with solderless, clamp type connectors on a rigid insulating board make connecting easy.

Acme Electric Corp., Cuba, N. Y.



Electric Tool

(29)

Nibbler, No. 16, is built for continuous production work in all types of sheet metal. It punches out small, rectangular pieces, leaving a smooth edge without bending or curling the material. It cannot be overloaded, and operates without vibration or distortion. Nibbler is powered by a special B & D built motor. Tool has sealed ball bearings throughout. The cutting die is made of high speed "nitrided" steel. Punch is reversible.

Black & Decker Mfg. Co., Towson 4, Md.



Speed Reducer

(30)

A new shaft-mounted speed reducer for many applications where complex multiple reduction belt or chain drives have been required. Ratio changes can be made in minutes by changing pulleys. A wide variety of pulley sizes makes the unit adaptable to a broad range of speeds. Speed reducer is available in most ratings from ½ to 40 hp at output speeds from 10 to 420 rpm. It is easily mounted on the driven machine, while a standard drive motor can be located on the ceiling, floor, or wall; in any position convenient to the user. Unit is available in single and double reduction ratings, in ratios of 5- and 15-to-one.

General Electric Co., Schenectady 5, N. Y.



Switchboard

(31)

A new automatic private switch-board has been designed for offices, factories and institutions requiring 20 to 46 private telephones. Switch-board comes completely equipped and requires only the addition of telephones to be placed into operation. Provides intercommunication service and has all the features of modern city type telephone service. In addition, special features are available such as paging, speakerphone, automatic code call, central dictation control, etc.

Telecom, Inc., 1019 Admiral Bldg., Kansas City 6, Mo.

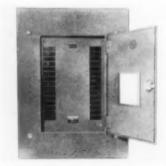


A new portable maintenance structure has integral fluorescent lighting and a hydraulically controlled, electrically or manually operated platform. Designed particularly for aeronautical and industrial maintenance applications, the equipment provides variable platform heights up to 17 ft and a high nonglare lighting level. Minimum platform height is 7 ft. A complete assembly consists of a 30- by 30-in. platform, and elevating shaft with control equipment, two 2-lamp



luminaires, a reel containing 250 ft of cable with grounding conductor, and electrical outlets for power tools. Electrical components operate at 120 volts. Luminaire mounting positions are variable—one may be mounted on platform; the other on the base. Both units may also be placed on opposite sides of platform or adjacent to each other in a "V" configuration.

Line Material Industries, Mc-Graw-Edison Co., 700 W. Michigan St., Milwaukee 1, Wis.

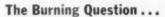


Panelboard

(33)

A new plug-in combination lighting and power distribution panelboard, designed to accommodate combinations of 1-, 2-, and 3-pole circuit breakers up to 54 poles. With a maximum rating of 240 volts, ac, and mains rated to 600 amps, the equipment is offered as either a panel-base assembly (Type TQLP) or as an assembled panelboard (Type TQLA). Both panelbase assembly and panelboard are specifically designed for G-E's new 15-50-amp single-pole and the common-trip type 2- and 3-pole Type TQL circuit breakers. Both panel base assembly and assembled panelboard are listed with UL.

General Electric Co., Plainville,



of how to attain better welding efficiency is answered by the new, improved flexibility of SIMPLEX TIREX WELDING CABLES. These expertly designed cables are easier to work with, easier to handle. Their jacket of cured-in-lead Neoprene Armor is the toughest known – engineered against damage by abrasion, oil, heat and water. Be sure- – specify TIREX WELDING CABLES. Order from your distributor; or for complete data, write for Booklet 1011.

SIMPLEX WIRE & CABLE CO.,

79 Sidney St., Cambridge 39, Mass.





WE'VE GROWN ACCUSTOMED TO

taking off in a plane . . . boarding a train . . . embarking on a ship . . . flipping a switch . . . turning a dial . . . pressing a button. We've grown accustomed to all the improvements and advantages electricity provides industrially and in our homes. We rely on them.

Yet this network of essential services cannot be more trustworthy than the terminal attached to the end of a wire.

A-MP solderless terminals have been designed and developed to meet the specific wiring requirements of electrical motivation, whenever and wherever it is generated, distributed, utilized or maintained.

Proven by use, A-MP termination is accustomed to increasing production volume, lowering manufacturing costs, improving the product's quality and efficiency.

Depend on A-MP termination, because you can.

The brochure "Molto Allegro" illustrating the scope of the AMP Organization and variety of A-MP wire termination will be sent on request.

AMP INCORPORATED

GENERAL OFFICES:

7328 Eisenhower Boulevard, Harrisburg, Pa.

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Distributor in Japan: Oriental Terminal Products Co., Ltd., Tokyo, Japan.

AMP BAMP BAMP BAMP



Power Switching Center

(34)

A new type of power switching center has wide application on industrial distribution systems where interrupter switches and fuse protection are desirable, on circuits up to 14.4 kv. They incorporate two or more interrupter switches, usually fused, in adjacent free standing housings. They are connected with one or more 3-phase buses and ground bus. They can be used for radial distribution systems; loop systems; continuous process systems with double bus feeders and for unit substations. Switches are normally manually operated, but can be provided with electrical operation. Centers can be supplied in nominal voltage ratings of 4.8, 7.2, 13.2 and 14.4 kv, and in current ratings of 600 amps, 40,000 amps momentary, and 1200 amps with 60,000 amps momentary. Literature is available.

R&IE Equipment Division of I-T-E Circuit Breaker Co., Greens-

burg, Pa.



Time Switch

(35)

Completely automatic control of intermittently operated equipment of all types is provided by a new 24-hour time switch. Switch will handle as many as 48 "On" and 48

Qwik |

Change

with PACKAGED MOTOR STARTER PARTS!



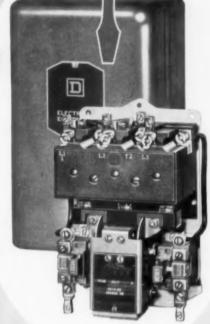
INTERLOCKS

A wide variety of quick-change, front-mounted interlocks adds flexibility for special applications



CONTACTS

Packaged replacement contacts are easily installed without disturbing wiring



PUSH BUTTONS AND SELECTOR SWITCH

These Kits contain all parts necessary to make quick changes from standard starters to either push button or selector switch controlled devices

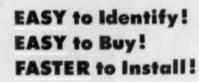


Screwdriver is only tool required for quick change of magnet coil to accommodate different voltages



O. L. RELAYS

A wide variety of easily selected, packaged overload relay heater units provides quick changes to meet varying requirements for overload protection



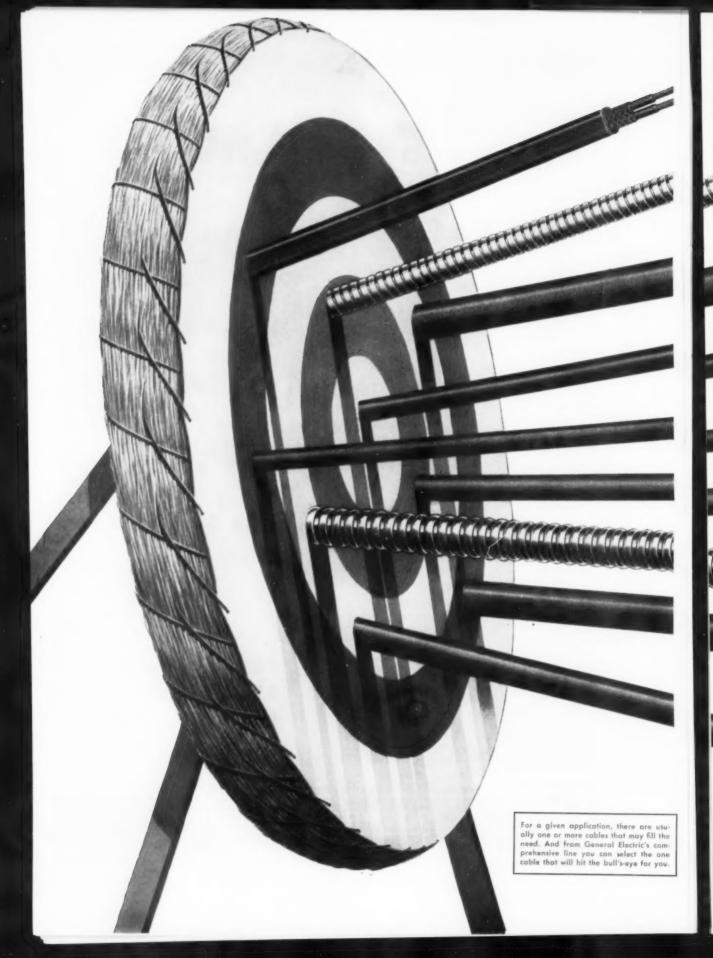


NOW...EC&M PRODUCTS ARE A PART OF THE SQUARE D LINE!

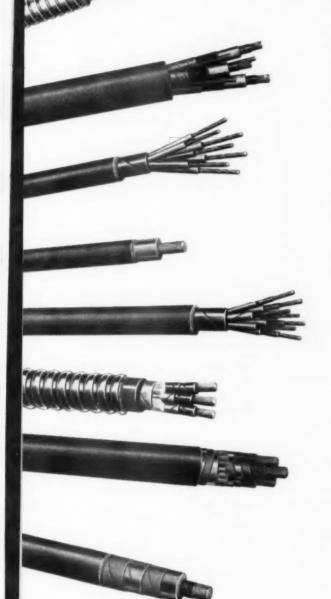
SQUARE | COMPANY

ELECTRICAL CONSTRUCTION AND MAINTENANCE . . . JUNE, 1957





The importance of accuracy in cable selection



Today, selection of the best wires and cables for your customers' particular needs demands that a wide variety of factors be considered, ranging from standard requirements such as flame-resistance, heat-, moisture-, and weather-resistance—to special constructions which withstand vibration, the electromagnetic effects of adjacent power cables—even the effects of atomic radiation.

General Electric has developed hundreds of cables for just about every possible application. Thus, General Electric engineers are never limited to one wire or cable for a given job but can suggest the most efficient and economical solution for the particular situation.

This is one of the important reasons why many electrical contractors work with General Electric wire and cable engineers when they're planning important wiring jobs. Another reason is General Electric's knowledge of the requirements of other basic components of power distribution systems—transformers, load centers, switchgear, etc.—the knowledge that the right cable plays an important part in satisfactory system performance.

All this adds up to experience that can benefit you. Take advantage of it the next time you have a cable selection problem. For information on your specific wire and cable application or selection problem, see the G-E wire and cable specialist in your locality or write Section W197C-618, Wire and Cable Department, General Electric Company, Bridgeport 2, Connecticut.

Progress Is Our Most Important Product

GENERAL



ELECTRIC





Lightweight

Speeds Up All Your Threading Jobs!

Better threads, four times faster than you can cut them by hand. That's the big reason why more and more contractors and maintenance men choose this powerful Oster No. 432 Lightweight Champ. With 1" pipe, for example, you can cut off, ream and thread in just 59 seconds—without work or strain.

Get all of the facts about this machine

the most versatile of all Oster Portables

from your nearby Oster Selective
Distributor — or write direct for free
literature and the names of your nearest
distributors.



for other Models write for General Catalog

THE OSTER MANUFACTURING CO., 1313 East 289th St., Wickliffe (Cleveland), Ohio

"OFF" operations in one day. Typical operations on which it can be used include oil wells, heating and air conditioning equipment, stokers, oil and gas burners, etc. A control dial, scaled in 15-minute graduations is used to set up a daily operating schedule. Running periods are set by sliding self-contained, non-removable trip levers in or out on the dial. The switch will repeat the entire schedule automatically each day. Mechanism is powered by a heavy duty, synchronous industrial motor, lubricated for life with low-temperature oil. Capacity is rated at 1000 watts using 60-cycle ac current. Action is single pole. double throw.

Zenith Electric Co., 152 West Walton St., Chicago 10, Ill.

Motors

(36)

4-pole motors, 220-volt, 1800 rpm, from 20 hp and up, are now available for service requiring an increment-start motor. Standard 2-step, 3-pole, general purpose starter, with a time delay of two to five seconds between the two steps, is used. In addition special wiring in connecting the Brook delta connected motor is required. In starting the ac increment-start motor, when the first set of contacts closes one-half of the motor winding is energized and rotor begins to turn. After this first step with its time lag the second set of contacts closes and the breakdown torque is then identical to across the line starting. The second step parallels the remaining one-half of the winding in with the first half thereby completing the circuit and rotor attains the full rated rpm.

Brook Motor Corp., 3553 West Peterson Ave., Chicago 45, Ill.

Meter Socket

(37)

A new 100-amp ringless meter socket, known as the "500", features a deep-drawn and flanged onepiece body; a neoprene gasket, a massive hub, swedged into position as an integral part of the box; and increased wiring space. It is available in 4- and 5-terminal styles, lay-in type connectors, accommodating Nos. 2, 6 and 10 wire simultaneously or up to and including No. 1/0 wire. The ground lug will take two No. 1/0 wires. Surge gap grounding facilities are standard on all sockets, while disconnect and by-pass facilities are optional.

Superior Switchboard and Devices Company, Canton, Ohio



Electricians everywhere are saying, "The new C-H 4151 is IT. There is nothing like it on the market." You'll say so too...for three big reasons. It installs easier. It works better. It lasts longer. Check these features.

Installs easier—The high strength phenolic molded unit base can be easily removed and replaced by two screws for 3-point mounting of the enclosing case and wire pulling freedom. All "easy-tite" terminals are out-front eliminating skinned knuckles and wire "pretzel" bending. "Easy-tite" terminals make wiring as simple as one, two, three. 1. Insert wire in hole provided. 2. Pull down to screw terminal. 3. Tighten.

Works better—Solid silver double break butt type contacts have long been standard equipment on quality motor control, and now Cutler-Hammer's exclusive A-c design incorporates all these features in the midget 4151 safety switch. Positive break of the butt type contacts is accomplished by the cam-

ming action of the toggle operator. A non-current carrying compression spring snap-closes the contacts when flipping the toggle to the "on" position. This spring can't heat and lose its tension; therefore, always insures constant and uniform contact pressure.

Lasts longer—Top performance at low cost is due to the 4151 being engineered for A-c service exclusively. Face-to-face closing of butt type contacts receive only a fraction of the wear common to other general use safety switches. Double break contacts halve the arc voltage and further increase the contact life. Solid silver contacts are known to have superior life to either copper or bronze. A Cutler-Hammer "first." A Cutler-Hammer exclusive.

Order the C-H 4151 midget Safety Switch from your authorized Cutler-Hammer Distributor today. CUTLER-HAMMER, Inc., 1306 St. Paul Ave., Milwaukee 1, Wis.



4151-H241 30 Amp. 2 wire S/N; 1 Fuse. 120 Volts A-c. Dimensions: 2½" x 5½" x 2½". List; \$4.50



4151-H261 30 Amp. 2 Pole; 2 Fuses. 120/240 Volts A-c. Dimensions: 4" x 5%" x 2%". List: \$5.60



4151-H341 30 Amp. 3 wire S/N; 2 Fuses. 120/240 Volts A-c. Dimensions: 4" x 5%" x 2%". List: \$5.90



Product Briefs

- (38) A new cable insulating tape, consisting of Mylar, Du-Pont's polyester film, laminated to aluminum foil has been developed by the Dobeckmun Company, Cleveland, Ohio, for the General Cable Corp., N. J. . . . (39) Radar-Eye is a motion detection instrument that protects industrial and commercial business against vandalism, burglary or intrusion. It is manufactured by Radar-Eye Corp., Natick, Mass.
- (40) A heavy duty electric generator for use with trucks and tractors to provide 115-volt single phase ac power has been developed by Electric Controls, Inc., Wales, Wis. . . . (41) The development of a new ac sensitive relay with transistor amplifier has been announced by Cutler-Hammer, Inc., Milwaukee, Wis. . . . (42) T. J. Cope, Inc., Collegeville, Pa., has introduced a new positive grip pickup for recovering tools or rods lost in conduit.
- (43) Linemaster Switch Corp., Woodstock, Conn., has announced a new heavy-duty line of footswitches, including 40 models in four classes, two types. . . . (44) Orangeburg Manufacturing Co., Inc., Orangeburg, N. Y. and Newark, Calif., has commenced production of Orangeburg SP plastic pipe. . . . (45) A push-to-test indicating light unit that provides a quick and positive method of testing for burned out lamp bulbs on control panels and pushbutton stations, is being made by General Electric Co., Schenectady, N. Y.
- (46) Midwest Electric Manufacturing Co., Chicago, Ill., has introduced a new insulating bushing which is molded from black butyrate, a tough resilient material having both high mechanical and dielectric strength. . . . (47) Three new lines of thin-wall diamond coring bits for the maintenance, building and construction trades has been announced by Diamond Products, Inc., Elyria, Ohio. . . . (48) Triex non-metallic sheathed cable with ground now color coded green for quick identification. It is manufactured by Triangle Conduit & Cable Co., Inc., New Brunswick, N. J.
- (49) Three new portable electric drills have been announced by Black & Decker Mfg. Co., Towson, Md.—the new ½-in. heavyduty drill, å-in. heavy-duty drill, and å-in. standard drill.

Catalogs, Bulletins and Engineering Data

- (50) Motor Control Center which permits savings up to 50% in floor area is described in 24-page Bulletin GEA-6367A. Listed are ratings, dimensions, installation data and guide form specifications. General Electric Co., Distribution Assemblies Dept.
- (51) ALUMINUM BUS conductor handbook. 280-page publication presents facts and figures, graphs, tables and photographs with comparatively little text on the properties and uses of aluminum bus conductor. Aluminum Co. of America
- (52) DECORATIVE FIXTURES; handbook of advanced lighting designs for architects, decorators, electrical contractors and dealers. 32-page booklet aims at stimulating new lighting ideas for important residential and public area locations. Lightolier, Inc.
- (53) CONDUIT FITTINGS. New weathertight 90-degree pulling elbows are illustrated and described with complete specifications and pricing information in new catalog sheet TCF-457-2. Appleton Electric Co.
- (54) Fractional Horsepower Motors for power tools, heating and ventilating equipment, compressors, fans, water pumps and machine tools. Bulletin GEA-6424, 16 pages. General Electric Co.
- (55) PACKAGED SUBSTATIONS for industrial applications. Bulletin 2006A shows drawings, dimensions and catalog numbers for the selection of a package substation, including structure, air switches, lightning arresters, fuse disconnects, bus supports, conductors and grounding material. I-T-E Circuit Breaker Co., R&IE Div.
- (56) Insulating Materials. Varnishes, enamels, primers, finishes and compounds as well as Class A, B and H insulations are discussed as to type, characteristics and application. Booklet B-7206. Westinghouse Electric Corp.

- (57) ELECTRIC THERMOSTATS for control of temperature on industrial equipment, refrigeration, ventilating, heating and alarm systems, and commercial and laboratory equipment are described in five new 4-page bulletins RT-803 through RT-808, giving complete specifications, dimensioned drawings and operating details. Robertshaw-Fulton Controls Co.
- (58) Transformers and Reactors for mercury lamps. 4-page Bulletin GEC-1440 gives application, price and dimension data, wiring diagrams, and new model numbers of a variety of construction types for 120- through 480-volt operation, 60 cycles, high and low power factor. General Electric Co.
- (59) TAPES for permanent moisture sealing, rapid insulation buildup, permanent cable jacketing, high-voltage cable splicing and general insulating purposes are described in new catalog. Bishop Mfg. Corp.
- (60) ELECTRIC CLIPS for every quick, temporary connection in the electrical, electronic and automotive field. New catalog describes complete line of alligator, test and battery clips. Mueller Electric Co.
- (61) Voltage Regulators. Bulletin RV2 describes application, operation, features, ratings, physical data, and accessories of new RSD, single-phase, 60-cycle pole type regulators in voltage classes of 2500, 5000 and 7620 volts. Line Material Industries, McGraw-Edison Co.
- (62) SPECIALTY TRANSFORMERS, dry-type, for general light and power service. 4-page Bulletin GEC-1431 gives application, price, new dimension and model number data, and wiring diagrams on transformers commonly used to reduce the voltage of 240-, 480- or 600-volt distribution circuits to supply 120- or 240-volt loads. General Electric Co.
- (63) MERCURY SWITCHES for small load circuits rated from microvoltmilliamps up to 3 amps steady state



the new FLEXIBLE LIQUID-TIGHT **ELECTRICAL CONDUIT**



REDUCES MAINTENANCE PREVENTS SHUTDOWN EASY TO WORK WITH







FREE

IT'S LIQUID-TIGHT!

Flex-Seal has been designed specifically to meet the most adverse conditions-in chemical plants, machine shops, printing plants, food plants, breweries—any installation, indoors or outdoors, subject to moisture, coolants, salt air, corrosive fumes, chemicals, greases, abrasives, and other conditions that create hazardous wiring with ordinary conduit.

IT'S SUPER FLEXIBLE!

Because it bends easily to small diameters and because it fits the tightest corners and most irregular shapes, Flex-Seal is ideal for wiring on machine tools, motors, pumps, air conditioning towers, outdoor amusements, conveyors . . . machinery of every type.

IT'S ECONOMICAL!

Because the first cost is the last cost, Flex-Seal means genuine economy. It eliminates maintenance and prevents costly shutdown. Flex-Seal is easy to install too, cuts easily on the job without special tools. And, its machine grey finish stays cleaner-looking longer.

2 TYPES TO MEET EVERY REQUIREMENT





Sizes: 36" through 114" Color: Machine Grey Sizes: 36" through 2" For installation with standard liquid-tight electrical fittings

COLUMBIA CABLE & ELECTRIC CORP. BROOKLYN B. N. Y.

255 CHESTNUT STREET











- currents. Dimensions, electrical ratings and specifications. Data Sheet 114. Micro Switch, a Division of Minneapolis-Honeywell Regulator Co.
- (64) Motors designed for outdoor service in ratings from 250 to 900 hp are described in new bulletin 51B8606A. Weather-protected motors are recommended for the chemical industry, public utilities, water works, petroleum pipelines and refineries, paper mills, and mining industries. Allis-Chalmers Mfg. Co.
- (65) OIL CIRCUIT RECLOSERS, 220-mva Kyle Type W. Bulletin CR1W contains operating features, ratings, graphs, charts and tables giving time-current curves, duty cycle, interrupting and load ratings and specifications. Line Material Industries, McGraw-Edison Co.
- (66) STAGE LIGHTING AND CONTROLS. Bulletin SL-56 presents a set of design procedures for the basic layout of lighting and control equipment for the modern school stage, including schematic layouts showing typical locations of the various items of equipment. Hub Electric Co., Inc.
- (67) Substation Construction. 8-page brochure describes procedure in fabricating electrical transmission substations using prefabricated Erecticon parts. Charles E. Schuler Engineering Co.
- (68) ALUMINUM uses in electrical systems are illustrated in new 12-page brochure. Included is detailed information on aluminum cable, rigid aluminum conduit and aluminum bus conductor, plus the use of aluminum in transformers, generators, lighting and motors. Reynolds Metals Co.
- (69) Current-Limiting Fuses capable of interrupting short-circuit currents up to 200,000 rms symmetrical amperes are described in 8-page bulletin GEA-6319B. General Electric Co.
- (70) TEMPERATURE CONTROL for heating, ventilating and air conditioning equipment. 4-page Bulletin F 2287-4 explains Electrionic system, components and accessories. Barber-Colman Co., Temperature Controls.
- (71) Ballast Heating. 8-page Bulletin GED-3328 points out basic heat problems and describes what causes overheating in fluorescent lamp ballasts, giving steps to avoid heating and associated problems. General Electric Co.

- (72) WELDING ALLOY—the right material for every job—may be chosen with the aid of a new Selec-Tic wall chart which also gives bonding temperatures, tensile strengths, and hardnesses of more than 150 low-temperature welding alloys. Eutectic Welding Alloys Corp.
- (73) BALLAST SOUND. Bulletin GED-3164, 8 pages, shows how ballast noise is combated through research, engineering and manufacturing. General Electric Co.
- (74) LIGHTING UNITS with special attachment for plugging into Bull-Dog Trol-E-Duct systems are illustrated and described in new catalog sheet. Fixtures are suitable for lighting store windows, interiors, galleries, displays and exhibits. Swivelier Co. Inc.
- (75) CIRCUIT BREAKERS rated 150 mva or higher—their operation and application. Bulletin GED-3337 includes exploded schematic drawing, photographs, and one-line diagram of typical system employing metalclad switchgear with Magne-Blast breakers employing new stored energy closing mechanism. General Electric Co.
- (76) RETRACTING CORD REELS. 16-page color catalog gives complete descriptions of entire line of automatically controlled retracting cords. Cordomatic, Div. of Vacuum Cleaner Corp. of America.
- (77) REEL CART with 1500-lb capacity is illustrated in single-page brochure. Photos show versatility as a reel lift cart, as a meter stand, as a turntable stand, and as a payout for reeling and coiling. Reel-O-Matic unit uses hydraulic jack for power operation. Columbia Products, Inc.
- (78) DC TIMING MOTORS—their function, construction and operation. Bulletin AWH MO 805 catalog sheet includes cut-away view of motor, with complete specifications. A. W. Haydon Co.
- (79) RESIDENTIAL LIGHTING fixtures featuring copper, brass and aluminum finishes in both traditional and modern styles are detailed in new 1957 full color catalog. Imperial Lighting Products Co.
- (80) Part-Winding Starters. 4-page Bulletin GEA-6606 discusses advantages of new two-thirds partwinding starting and gives application data, connection diagrams, and price information on new CR7050 part-winding starters. General Electric Co.

- (81) PANELESCENT LAMP which produces light by the principle of electro-luminescence. 4-page brochure details the construction and characteristics of the new lamp. Sylvania Electric Products Inc.
- (82) FLUORESCENT FIXTURE. 4-page catalog illustrates completely luminous plastic-enclosed Quentin fluorescent fixture, including lighting application and construction details. Fullerton Mfg. Corp.
- (85) CIRCUIT-BREAKING FITTINGS. Receptacles, plugs and cable connectors in 30, 60, 100 and 200-amp lines rated at 600 volts ac and 250 volts ac or dc are completely illustrated and described in 20-page bulletin. Russell & Stoll Co. Inc.
- (86) STREET LIGHTING. New bulletin GEA-6462 is designed to aid in planning celebrations to mark the installation of new street lighting systems, providing a 5-step plan for organizing an effective "light-up" celebration. General Electric Co.
- (87) MERCURY VAPOR FLOODLIGHT-ING. 16-page illustrated bulletin contains data on lamp color and operating characteristics and floodlight beam characteristics, plus suggestions on how to minimize a stroboscopic effect. Descriptions, specifications, dimensions and photometric data are also included for line of floodlighting equipment. Crouse-Hinds Co.
- (88) CONTROL TRANSFORMERS of the normal reactance type, designed to supply various low voltages for many types of industrial as well as household appliances from 115, 230, 460 or 575-volt circuits are described in 4-page Catalog 956. Hindle Transformer Co., Inc.
- (89) Welding Control. Bulletins GEA-6408 and 6593, 12 and 4 pages, respectively, describe new line of standard and custom non-synchronous resistance welding controls, discuss variety of available combinations, list typical applications, and explain use of plug-in control units and ignitron applications and for sequence control of automated machines. General Electric Co.
- (90) GARDEN LIGHTING. New brochure covers garden and play area lighting equipment, including a Pathlite available as a head unit only or with an aluminum ground spike; an outdoor twin receptacle fixture for underground wiring; and several models of border lights, post lights and utility lights. Steber Mfg. Co.

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250 200-150-



Reader's Quiz

QUESTIONS from readers on problems of industrial equipment, installation, maintenance and repairs. Answered by electrical maintenance engineers and industrial electrical contractors out of their experience. For every question and every answer published we pay \$5.00.

Drilling in Poles

OUESTION Y31-We have a 45-ft pressure treated pole in which holes are bored at approximately 15 ft from the ground. On the pole we used standard & in. galvanized hardware. We use a th in. drill to make the holes. In some of the older installations, the lineman drilled two holes at 90° to each other and separated by only 1-in. of spacing. The pole diameter at this point was 10-in. What fractional part of the total strength was lost by the drilling? Is there any code that designates the minimum spacing between holes when drilling at 90° from each other? In a case like this would it be advantageous to use pole bands with attachments set at 90° to one another and not drill the pole at all?-M.D.

ANSWER TO Y31—Drilling even a tiny hole from one side, 1-in. deep will allow insects and rot to reduce the pole strength far more than the wood removal. The clamp will help. Use guy wires to take care of wind and ice loads. While broken wires on one side are not common, without guy wires you may get a broken pole.—H.S.

ANSWER TO Y31—Such a small part of the total strength of the pole is lost by the drilling you mentioned that it is not worth figuring on a pole 10-in. in diameter. The only code I have gone by is a matter of good construction practice, and I have never had a pole break from drilling holes 90 degrees and an inch or less apart. Considerable depends on what is being mounted on the pole and the direction of the resulting forces.—W.E.G.

Mechanical Brake

QUESTION Z31—We are using a 3-phase, 220-volt, ½ hp motor to drive a 500-lb trolley at a speed of 100 ft per minute. We drive this trolley 10 ft then brake it to a stop in approximately 7 in., after which the trolley is returned to center and the cycle repeated.

We are using a friction disc-type mechanical brake, but find that this brake is affected by rapid wear, humidity and dirt. Therefore, we cannot obtain the precision and accurately positioned stops that are necessary for this operation. Can someone help with this problem?—
J.M.

ANSWER TO Z31-There is on the market a device called the "Dynac" controller which is manufactured by Westinghouse Electric Corp., that is designed to smoothly stop squirrel-cage or wound-rotor ac motors. This is accomplished by supplying a dc potential across one of the motor stator windings after the ac supply is removed. The dc is supplied only long enough to stop the motor. Since the braking is accomplished by electrical means only, relatively little maintenance or parts replacement is needed; and work stoppage periods are practically eliminated.

The controller itself is entirely self contained in one enclosure, including the rectifying equipment. The unit is also factory preset to give desired braking requirements, and usually needs no further adjustments after final adjustments are made at the time of installation. The entire operation can be made almost entirely automatic, if desired.—L.N.

ANSWER TO Z31—I have had a similar experience with mechanical friction type brakes. It has proven impractical to use a brake for precision stopping due to the causes mentioned in J.M.'s question, as well as other factors such as load and voltage variation, which change the load momentum and cause changes in braking requirements.

Two other methods have been used with good success and reduced maintenance. One is the installation of a plugging switch and plugging control to plug the motor to a stop and then apply the brake. This reduces the duty cycle and exacting braking requirements on the friction brake and results in accurate stopping. Maintenance and brake adjustments are reduced to normal.

Another scheme we have employed with very good success is using an air cylinder to move the load. This permits very precise stopping since the distance the load moves is fixed by the length of the cylinder. This method also provides smooth movement and cushioned stopping of the load, resulting in vibration-free operation.—R.E.B.

ANSWER TO Z31—Several companies in this city have installed Westinghouse Dynac brakes. The mechanical brake is employed only to hold the load after the motor comes to a complete stop, thus resulting in practically no wear on brake linings.

The principle on which this brake works is very simple. A rectifier with its necessary controls is installed in the motor circuit. When the motor switch is opened, do is applied to the motor windings for a fraction of a second. This magnetizes the armature and brings it to a complete stop within a predetermined time. Since the do is applied for only a few seconds, a mechanical brake is then needed only to hold the load.

One company in this vicinity has saved \$60.00 per month on a 200 hp installation in brake linings alone, not including downtime or labor of repairs.

I would suggest that you contact your nearest Westinghouse Electric Supply Corporation for full information.—C.A.H.

Lawn Sprinkler Control

QUESTION A 32-There is a demand in my territory for a lawn sprinkling system using a single valve having six or eight pipe connections. Only one water pipe is to be supplied at a time, the valve having means to turn the supply from one pipe to another. To motorize the valve and control it by means of a time clock would be the ultimate aim in developing this system, the idea being to automatically supply water to one outlet for approximately a half hour and then to succeeding outlets for a half hour each.

Have any of the contributors to the Quiz section had any experience or knowledge that would be useful in the development of the system described?—B.A.S.

ANSWER TO A32—Here is a method of lawn sprinkler control which should help B.A.S.

I use a "header" type of distribution; that is—if all lines emanate from a basement or other point outward in one general direction I burn holes in a length of pipe (usually 3-in. I.D.) large enough to weld 7-in. pipe sleeve couplings



This report proves it costs many dollars more for the non-certified ballast you buy for a few nickels less

Certified Ballast Manufacturers, cooperating with lamp manufacturers, have set rigid standards for fluorescent ballast performance. A ballast that meets or exceeds minimum CBM specifications assures you rated lamp life and full light output, cool operation, reliable striking, and long ballast life. It carries a diamond-shaped CBM emblem. Without CBM specifications, there would be no standards for performance . . . no floor under quality.

Sola ballasts for general lighting applications meet or exceed CBM specifications or proposed specifications wherever they exist. Sola has no "secondary line" that does not meet the accepted minimum standards. Sola ballasts carry both the UL (Underwriters' Laboratories) emblem and the CBM emblem.

Other manufacturers are now making ballasts which are not designed to meet CBM standards. These ballasts bear only the UL emblem. In order to save a

few cents, many people are using these ballasts, apparently under the impression that the UL emblem assures satisfactory lamp performance. It does not. UL performs valuable, but highly specialized tests, for safety only. UL does not test for operating characteristics that assure efficient, economical lamp performance and long lamp life.

We have prepared an engineering report analyzing the cost of lighting systems using non-certified ballasts as compared with systems using CBM certified ballasts. This report shows that while the initial cost of non-certified ballasts may be a few cents less, lighting systems incorporating them cost the user many dollars more in terms of reduced lumen output and reduced lamp life.

Write today for your copy of "An analysis of fluorescent lighting system costs as affected by ballast performance".

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along one side. Length is determined by number of lines attached. Into each I fit a 4-in, nipple, ½ or ½-in, according to size of line used. To this I add a solenoid valve of that size rated 115-125 volts, ac.

One end of the "header" is closed with a standard pipe cap. The other has a reducer to not less than a 1-in. supply line depending on number of sprinkler heads per line.

For solenoid program control I use a stock time switch of the multiple operation type supplied by several manufacturers.

They cost around \$10.00 to \$50.00 depending on type of control desired. They are obtainable in single phase 115-230 volts with a wide variety of settings. I use a by-pass switch around the clock for simultaneous sprinkling at rare intervals. This does not interfere with clock settings.

If the sprinkler lines emanate from a central point, as the spokes of a wheel, I use a short section of 8-in. or 10-in. pipe and supply line entering either top or bottom as required.

B.A.S. should standardize his installation as nearly as possible in order to offer one of two or three figures depending on the number of lines as; 1 to 4-, 2 to 6, etc., and if demand warrants—a stock of headers could be built up in spare time ready for quick installation.—J.B.J.

ANSWER TO A32—There is no valve that will automatically flow water from a single pressure source to a limitless number of outlets. The only practical solution, and the one used in this area, is to control each group of sprinkler heads with electrically operated valves.

To be completely practical, the motorized valve which you mention would not be suitable as it is a packed type valve and is relatively expensive. Many of the systems in this area use \$\frac{2}{3}\cdot \text{in}\$. two-way normally closed packless solenoid valves such as manufactured by the Automatic Switch Company. This valve can be buried in the earth with the piping when furnished with a molded waterproof coil or a NEMA 4 coil housing.

For automatic sprinkling you can connect all of the solenoid valves to a cam timer such as manufactured by the Automatic Temperature Control Company and arrange to operate the valves in sequence. To automate this process completely you can connect the cam timer to operate from a humidity control having probes stuck into



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HI-4 and HI-6 Bakelite Connectors — pressure cable connectors for general use in all types of Branch Circuit and Fixture wiring.

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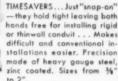
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Use on all sizes of Thinwall conduit or Greenfield—1/2" up. Fost action, simple to use. Just insert one blade . . . turn once to right, and back to left. That's all Pays for itself through the fittings it saves!

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CUT COSTS! Tops in dielectric qualities. Unaffected by atmospheric conditions. Made in 3 materials—ETHYL CEL-LULOSE, SARAN, NY-LON . . . high and low temperature ratings.

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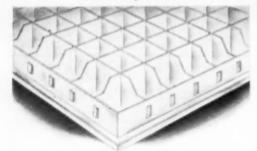
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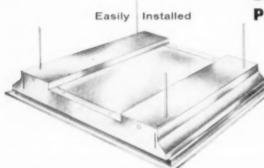
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Unique One-Piece Framed Louver Cannot Sag or Lose Its Shape

Interlocking aluminum fins are rigidly locked into hinged frames. The total weight of this large area fixture is reduced by 25% imposing less burden on the ceiling.

Louvers cannot twist or bend out of alignment...no unsightly wavy lines. Small cell size provides soft, even lighting. Lamp placement in relation to louver fins assures even brightness, ample shielding.

Die-Formed, Twin-Channel Housing Provides Greater Rigidity

Extra forming means greater rigidity without extra weight. The ballasts are located in channels. Heat from the ballasts is more efficiently dissipated because of the greater surface area provided.

Ease of installation is assured...hinged frames fit precisely...trim flanges fit snugly against the ceiling. Other sizes: $2' \times 2'$, $2' \times 4'$, $2' \times 8'$.

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COMPLETE COMMERCIAL LIGHTING



Also available with one-piece plastic shield.

Garden City Plating and Manufacturing Company 1730 North Ashland Avenue • Chicago 22, Illinois In Canada: Garcy of Canada, Ltd., 1244 Dufferin Street, Toronto 4 the earth. However, a time clock wouldn't do any good as the watering needs of the lawn depend upon weather conditions rather than the time of day.—H.G.C.

Copper Wires

QUESTION B32—Some copper wires of the same size and number of strands are more brittle than others. Is this the fault of the copper refining process or the insulation?—H.S.

ANSWER TO B32-Variations in workability and brittleness of copper are usually due to the annealing or tempering treatment that the metal has been subjected too. In general, heating and quenching copper softens it whereas hammering or drawing operations tend to harden it and make it brittle. Wire that is hard drawn has greater tensile strength than soft drawn wire. but soft drawn wire has lower resistance and is more easily shaped into eyes and other forms. Naturally the temper of copper wires will vary from one manufacturer to another due to differences in drawing methods and annealing treatments. In the general case the type of insulation will not affect the characteristics of the conductors .--L.D.B.

ANSWER TO B32—No fault of either. I have noticed it myself, and find it varies with manufacturers. I believe it comes about due to different manufacturing methods, although aging can do the same thing.—W.E.G.

ANSWER TO B32-Copper wires are made of different kinds of copper. The insulation is different also, for the use to which it is put. These different wires are compared as to ductility and not size. There are three different kinds of copper wires. They are classed according to hardness. Hard drawn, medium hard drawn, and soft or annealed. The soft copper is used in every kind of covered wire except weatherproof covered wire. This weatherproof wire comes in all three hardnesses of copper wire, and it is the only one that does. The reason for this is that weatherproof wire is the only wire that is normally strung over heavy spans out of doors, and for that reason, the added strength that is obtained by using either hard drawn, or medium hard drawn copper for a conductor, is essential.

When rubber is used for insulation, the copper is tinned to protect the copper from chemical reaction with the rubber because of contact. This tinning is done by coating with pure tin.—J.W.L.

Heater Ratings in Delta Hookup

QUESTION C32—I have a deltaconnected 440-volt resistance heater. The resistance of one side of the delta is 150 ohms. How do I find the watt rating and amp rating?—A.P.

ANSWER to C32—The 440-volt rating of the 3-phase resistance heater is a line-to-line voltage across the delta leg. Dividing this voltage by the known leg resistance will result in the leg current of 2.94 amps. The line current is 1.732 times this or 5.08 amps. The resulting wattage is the line current times the line-to-line voltage times 1.732 or 3870 watts.

It should be noted that these figures are based on a hot resistance of 150 ohms per leg. If only the cold resistance is known the hot resistance may be approximated as follows:

 $\begin{array}{l} (R\;hot/R\;cold)\;=\; \\ (234.5\;+\;t\;hot/234.5\;+\;t\;cold \end{array}$

Assuming a temperature of 600°C for t hot and 25°C for t cold, this reduces to:

R hot = 3.22 R cold

In this case R per leg would become 483 ohms, the line current 1.58 amps and the wattage 1206 watts.—L.D.B.

ANSWER TO C32-There are two possible solutions to your problem. The more likely of these is based on the assumption that the resistance in each leg of the delta is 150 ohms. In this case the current in each leg would be 440 volts/150 ohms or about 3 amps. The wattage per resistor can then be computed from the I'R formula, obtaining (3)1 x 150 = 1350 watts each. The total in the three sides of the delta would indicate a 4-kw heater. The line current, being \square 3 times 3 amps, is therefore 5.2 amps per phase. The power consumed by the entire unit can then be rechecked from the power formula $P = \sqrt{3} E I$, or √3 x 440 volt x 5.2 amps, giving 4000 watts.

The other solution assumes that the 150 ohms mentioned was obtained by measurement at the corn-





SIMPLIFIES INSTALLATION: Anaconda Silvaline Type SE Cable-in ratings up to 200-Amps-

SILVALINE TYPE SE CABLES - 100-AMP RATINGS OR MORE

(Copper Conductors)

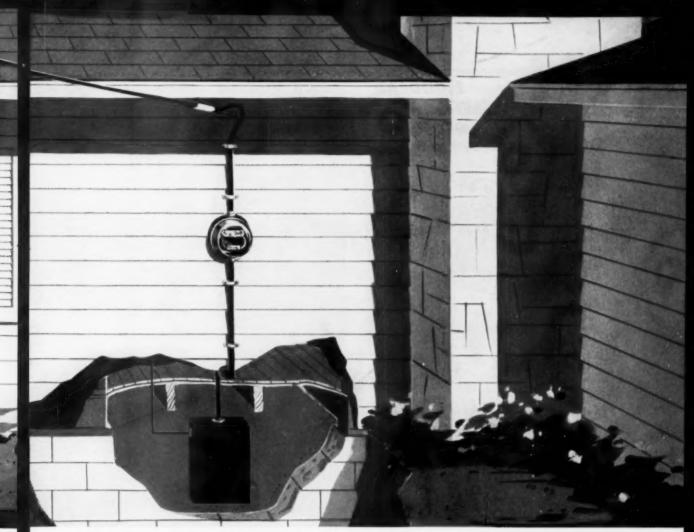
CONDUCTOR	INSULATION	(in amps)
3 / C #3 with #3 or #5 neutral	RHW 75C	100
3/C #2 with #2 or #4 neutral	RHW 75C	115
3/C #1 with #1 or #3 neutral	RHW 75C	130
3 C #0 with #0 or #2 neutral	RHW 75C	150
3 / C #3 / 0 with #3 / 0 or #1 / 0 neutral	RHW 75C	200

(Aluminum Conductors)

CONDUCTOR	INSULATION	(in amps)
3/C #2 with #2 or #4 neutral	RHW 75C	100
3/C #1 with #1 or #3 neutral	RHW 75C	110
3/C #1/0 with #1/0 or #2 neutral	RHW 75C	125
3/C #2/0 with #2/0 or #1 neutral	RHW 75C	150
3/C #3/0 with #3/0 or #1/0 neutral	RHW 75C	170
3/C #4/0 with #4/0 or #2/0 neutral	RHW 75C	200

Even with 200you can install

Anaconda Silvaline* Type SE Cable is available in both copper and aluminum in sizes up to #4/0—large enough to handle even 200-Amp service. No conduit needed with Silvaline; save time and money in installation.



can be installed without conduit from weatherhead to meter to fuse box, and then to range,

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Even with higher ratings no conduit is required with Silvaline Service Cable. And it's fully approved.

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No complaints. Silver finish on Silvaline takes any type or color of house paint . . . won't bleed through, flake or peel. Ends customer complaints.

Silvaline can be installed from pole to meter to panel box—and then to range.

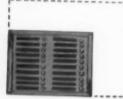
See the Man from Anaconda or your Anaconda distributor for full information. Also—send for folder on Silvaline Type SE Service Cable. Anaconda Wire & Cable Company, 25 Broadway, New York 4, N. Y.

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REQUIRE LESS THAN
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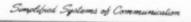
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To see how you can have a custom-built register system at standard system cost, write today for Bulletin H9.



S. H. COUCH COMPANY, INC., NORTH QUINCY 71, MASS.



ers of the delta. Here, the resistance, R, of one leg is in parallel with the other two legs in series. This may be solved by the formula:

 $\frac{1}{150} = \frac{1}{R} + \frac{1}{2RR} = 225 \text{ ohms per leg}$

The current in each resistor would then be 440/225 or about 2 amps, and the wattage as computed above would be 900 watts. The entire unit would consume 2700 watts and the line current being $\sqrt{3}$ x 2 amps would be $3\frac{1}{2}$ amps.

The foregoing figures have been rounded out because most manufacturers rate their units at utilization voltages of 115, 230, and 460 or sometimes 440 volts, and in even wattages as indicated above.—

ANSWER TO C32—If the resistance of one side of the delta when the delta is opened is 150 ohms, phase current can be found by Ohms law.

$$I_p = \frac{E_p}{R_p} = \frac{440}{150} = 2.93 \text{ amps.}$$

Line current for delta connections is found by the formula,

 $I_{+} = 1.73 \times I_{p},$ $1.73 \times 2.93 = 5.07$ amps per line.

The power is found by, P = 1.73 C EI X pf. Since the load is resistive, power factor is 1.00 and,

$$P = 1.73 \times 440 \text{V} \times 5.07 \text{a} \times 1.00$$

= 3860 watts or 3.86kw.

If however, the 150 ohms resistance is that resistance between two of the line leads when the delta is closed, as when the heater is ready for use, then the current per phase and line may be found if the resistance per phase is known. One method is to consider the circuit as one in which when looking into line leads 1 and 2, the A phase is in parallel with the series circuit made up of the B and C phase. The problem then is one in which the combined resistance of three equal resistances connected as above is 150 ohms.

If we assume a single phase or dc voltage connected to line leads 1 and 2, current will flow through the branches of the parallel circuit inversely as their resistances. Since the resistance of path B and C is twice that of path A, one third of the total current flows in BC, and two thirds of the current in A.

Assume a convenient voltage, say 150 volts. By Ohms law,

150V = 1 amp, total current. with two thirds of an amp in A, and one third of an amp in BC, the resistance of A is



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5-36	Hyd. hand pump	$1\%_4,1\%_2,2,2\%_2,3,3\%_2,4^{\prime\prime}$ rigid conduit and pipe
New S-130 1-bite	Hyd hand pump	$V_0 \sim 2^{st}$ rigid conduit and pipe
New 5-132 1-bite	Electric-powered pump	V_2 - 2^{cc} rigid conduit and pipe
New S-137 1-bite	Hyd. hand pump	$11_4,11_5,2,21_3,3,31_2,4''$ rigid conduit and pipe
New 5-138 1-bite	Hyd, hand pump	$1\frac{1}{4}$, $1\frac{1}{2}$, 2 , $2\frac{1}{2}$, $3^{\prime\prime}$ rigid conduit and pipe
New 5-139 1-bite	Electric-powered pump	11/4, 11/2, 2, 21/2, 3" rigid conduit and pipe
New 5-140	Electric-powered	$1\frac{1}{4}, 1\frac{1}{2}, 2, 2\frac{1}{2}, 3, 3\frac{1}{2}, 4^{\prime\prime}$ rigid conduit and pipe

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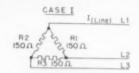
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 $\frac{150\text{V}}{66a}$ = 227.3 ohms. When connected

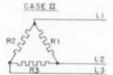
to 440V, 3 phase current is $\frac{440\text{V}}{227.3 \text{ ohms}}$

Line current is $1.73 \times 1.94 = 3.36$ amps. Power is $1.73 \times EI \times pf$, $1.73 \times 440 \times 3.36 = 2558$ watts or 2.56 kw.—G.R.V.

ANSWER TO C32-"Your question lacks one detail which requires that two answers be submitted. You do not state whether the 150 ohms of one side of the delta resistance was measured apart from the other two resistances or parallel to the other two in series. Therefore, for Case I, I shall assume that you have three 150 ohm resistances. delta connected. In this case the current per resistance is 2.93 amps. the wattage is 1290 watts, the line current is 5.08 amps and the total wattage is 3870 watts. (See calculations below).



$$\begin{split} I_{\{R1\}} &= \frac{440V}{150\Omega} = 2.93 \text{A} \\ \text{Wotts}_{\{R1\}} &= I^2 \text{R} = (2.93)^2 (150) \text{=} 1290 \\ \text{Total watts} &= 3 (1290) \text{=} 3870 \\ I_{\{\text{Line}\}} &= \frac{3870}{\sqrt{3} \cdot (440)} \text{=} 5.08 \text{ amps} \end{split}$$



Equivalent resistance as measured across L1-L2, or L2-L3 or L1-L3=150 Ω Then 150 Ω = $\frac{(R1)(R2+R3)}{R1+R2+R3}$

R1+R2+R3

If R1 = R2 = R3 then I50 $\Omega = \frac{R1(R1+R1)}{R1+R1+R1} = \frac{2(R1)^2}{3R1}$ $\frac{2}{3}(R1) = 150 \Omega$

RI = 225Ω = R2 = R3 $I_{(R1)}$ = $\frac{440}{225}$ = 1.955 omps Wotts $_{(R1)}$ = I^2R = $(1.955)^2$ (225) = 860Total watts = 3(860) = 2580

 $I_{(Line)} = \frac{2560}{\sqrt{3}} = 338 \text{ amps}$ = LEGEND =

I (Rt) " Current in each individual resistor

I (Line) "Current in feeder to delta bank of resistors

Note: Assume in both cases that R1 = R2 = R3

For Case II, I shall assume that the effective resistance of R1, R2 and R3 is equal to 150 ohms and that R1, R2 and R3 are equal values of resistance. In this case, the current per resistance is 1.95 amps, the wattage is 860 watts, the line current is 3.38 amps, and the total watts is 2580. (See calculations above).—R.C.L.

New Sears, Roebuck and Co. Store at Nashville has 178,961 sq ft of floor space. All wiring is protected by SPANG HD and SPANGLEAM EMT.





59,000 ft of SPANGLEAM EMT, 77,170 ft of SPANG HD went into this store. Easy handling of conduit saved time, kept costs down.

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says Mr. Leon Harlan, Ramsey Electric Co., Nashville, Tennessee

"We installed 77,170 ft of Spang HD Galvanized Conduit and 59,000 ft of spangleam EMT to protect the wiring in the new Sears, Roebuck & Co. store at Nashville, Tennessee," reports Mr. Harlan. "Because it was so easy to work with, we saved considerable time on installation which also helped keep costs down.

"Spang HD was easy to cut and thread. Bending was fast and accurate. The conduit was clean and free of burrs and obstructions which otherwise might have caused trouble on wire pulling.

"We used spanGleam EMT for short runs, and we had good results with it, too. The EMT was delivered bundled with blue plastic tape instead of rope. This was an important safety factor, because the tape makes a strong bundle and lengths don't slip out of place."

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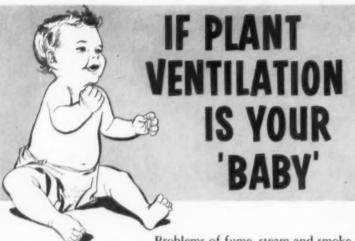
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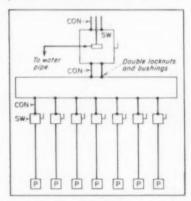


DOME TYPE

Power Line COMPANY PLAINFIELD, NEW JERSEY

Can You ANSWER These QUESTIONS?

QUESTION M32-If the voltage is 120/208 4-wire, would it be considered grounded, if the boxes were equipped for 13-in, knockouts and you used the 1-in, knockout for 1-



in, conduit. Would it not require bonding jumpers and grounding bushings to be sure of a continuity to ground? See sketch above .-R.L.H.

QUESTION N32-If a load is supplied from a generating station over a transmission line, is there any way other than the "cut and try method" of determining the voltage at the load and the current necessary to supply a certain number of kilowatts to that load, knowing the voltage at the generating station? -G.J.P.

QUESTION P32-Do all capacitors with dc ratings have an ac rating also? How does the electrolytic capacitor differ from other types? What determines the type capacitor to use for various applications?-

QUESTION Q32-In one part of our plant we have a wye connected. 3-phase 4-wire, 220-volt ac system with the neutral grounded, and in another section of the plant, power is supplied by a 3-phase, 220-volt ac delta connected ungrounded sys-

A review of our motor burn-outs and motor faults has revealed that a greater percentage have developed on motors connected to the delta ungrounded system.

Can anyone with similar experience suggest the cause and remedy? R.E.B.

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Questions on the Code

Answered by

B. A. McDONALD, New York Board of Fire Underwriters, Rochester, N. Y.

GLENN ROWELL, Electrical Engineer, Fire Underwriters Inspection Bureau, Minneapolis, Minn.

B. Z. SEGALL, Consulting Electrical Engineer, New Orleans, La.

AC Switch: Comment

The type AC switch may be used up to full rating for the control of fluorescent lighting fixture loads.

To a reader's question (April, page 253) regarding the application at full rating of the new type AC switch to fluorescent lighting loads, G. R. replied, "No", quoting the "twice rating" clause of Article

3814c as applicable.

G. R.'s reply was contrary to widely accepted interpretation and was protested by several representatives of the wiring device manufacturers and others. The first of these comments was received in time for inclusion in the May issue (page 253) from P. H. Winter, chief engineer, Pass and Seymour, and Chairman of the Wiring Device Section of NEMA.

Subsequent comments received took substantially the same posi-

tion.

Rollin Peck, secretary, Arrow-Hart and Hegeman: "Very definitely contrary to the latest official report and listing from the U.L.—'Underwriters' Laboratories, Inc. now lists in the flush and surface types only, AC general use switches which have been tested for controling resistive, inductive (including fluorescent lamp) loads up to the full current rating."

O. L. Taylor, manager of engineering, Bryant Electric Co.: "The 1956 edition of the National Electrical Code, under paragraph 3814, section (c), states, "Switches controlling inductive loads shall have an ampere rating twice the ampere rating of the load unless they are of a type approved as part of an assembly or for the purpose

employed.'

"The AC switch is the exception covered by the italics of the quotation above and is rated by the Underwriters' Laboratories Inc. to carry the full ampere rating for inductive loads. The various codemaking panels have approved this interpretation; and inspectors, engineers, and architects have approved use of AC switches for the

past few years in accordance with this interpretation."

H. H. Watson, commercial engineer, General Electric Co.: "The question asked was, in effect, whether or not an AC switch of the type recently introduced could handle its rating of fluorescent lamp load. This load is an inductive load and under Section 3814c a switch approved for this purpose is acceptable. As far as I know all AC switches so far introduced are so rated and are being installed to handle fluorescent lamp loads without the 50% rating required of T rated switches."

Glenn Rowell amends his previous answer as follows: "In the preparation of the article concerning general use Type AC switches, which appeared in the April issue, I should have, without any question, explained that many manufacturers of this type of switch had obtained a standard rating from the Underwriters' Laboratories covering general use AC switches on inductive as well as non-inductive loads, including fluorescent lamp loads. Mr. Winter, therefore, is definitely right and I am at a loss to explain why Section 3814 of the Code is not more explicit. as it should, under item c of Section 3814, provide acceptance for this type of load if that was their intent.

"The actual definition of the term 'approved' refers to the authority enforcing the Code and not to Underwriters' Laboratories. Therefore without special reference in Section 3814 to the fact that the Type AC switch listed by Underwriters' Laboratories has been tested for inductive as well as non-inductive loads, I feel that both I and the panel responsible for this section are at fault.

"I therefore recommend that in the June issue a correction be included referring back to the April issue stating that all AC general use snap switches, either flush or surface types, listed by Underwriters' Laboratories are tested for controlling resistive, inductive and tungsten filament or fluorescent lamp loads up to the full current rating of the switch, and for motor loads up to 80% of the ampere rating of the switch."

It appears, therefore, that the consensus of current interpretation: a. Accepts Article 3814c as applicable to fluorescent lighting loads.

b. Accepts the clause in 3814c, "unless they are of a type approved . . . for the purpose employed", as applicable to the type AC switch—W.T.S.

Motor Circuit Protection —Circuit Breakers

We are planning on moving a large number of machines into a building which will soon be available to us. It is our present intention of using bus duct and circuit breakers exclusively.

When looking at column 6,7 and 8 in Table 20, it seems as though the majority of motors should be classed under any of the three columns. Most motors have no code number, are squirrel cage construction, and are full voltage or across-

the-line start.

On a number of new machines received in the plant in the past, the control panels have had a circuit breaker ahead of all the contactors and controls. It is impossible to place them in any one particular column due to the wide variation of size of breaker used. Some seem too large and others too small, yet the small ones carry the starting load without tripping.

Will you explain how to arrive at the proper breaker to use or where and how to find it in the Code? Also, what is your recommendations on using as small a breaker as possible if it will carry

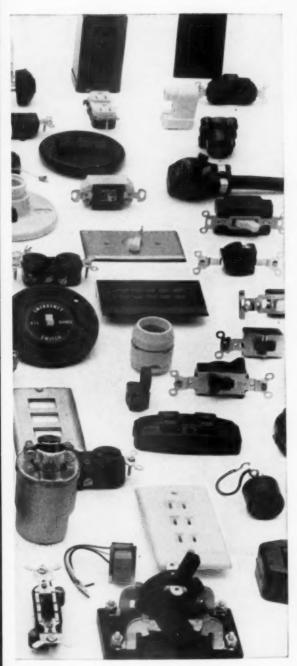
the starting loads-F.F.

A. The 1956 revision of the N. E. Code clarifies to a considerable extent the status of a circuit breaker with respect to columns 7, 8, 9 and 10 of Table 20, Chapter 10. According to the 1953 code, these four columns only covered the "maximum allowable rating of branch circuit fuses". The



182

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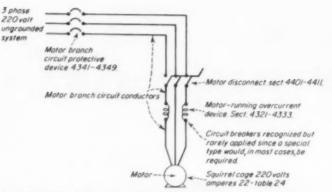
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- 1. Assume motor has no code letter and full voltage starting. Maximum rating or setting of branch circuit protective device. Table 20. Column 7, table 20. circuit breaker-70omps; fuse-70amps. Table 27: 300 % x 22A = 66 amp. Non-adjustable circuit breaker.
- 2 Assume motor has no code letter and outo-transformer starting Column 8, table 20: circuit breaker -50 amps; fuse -60 amps. Table 27: 250% x 22 amps = 55 amps. (fuse). Breaker 50 amps.

Section 4344: Recognizes an avercurrent device which would serve the dual role of protecting the branch conductors and also the motor Acircuit breaker having time-delay characterlistics suitable for both purposes may be used. This is not readily satisfied.

1956 Code definitely covers the rating of circuit breakers—used for this purpose and possibly clarifies the question you have raised. According to Section 4342 of the Code the maximum motor branch circuit overcurrent device is established by Tables 26 and 27, and the values obtained, which vary with the characteristics of the motor and the method of starting, are brought together under Table 20.

In order to further clarify the matter, I have shown by Fig. No. 1 just how Table No. 20 applies to a 3-phase, 220-volt squirrel-cage motor, rated at 7½ hp. I believe this example clarifies how the proper rating of a circuit breaker, used for a motor branch circuit protective device, is obtained.

In reply to your last question, which concerns the use of the smallest breaker possible to start the load, I can only recommend that the requirements of the Code be satisfied. Section 4346 of the code requires a fuseholder to be of a size to accommodate the fuses specified in Table 20, with an exception for time delay fuses. Circuit breakers are not so restricted. They shall have, as required by Section 4347. a continuous current rating of 115% of the full load current rating of the motor, and they shall be capable of carrying the starting current of the motor as provided in Section 4342. As a result, there may be several motor applications where the nature of the load would permit a breaker smaller than specified in Table 20, to function properly. Under such conditions I believe there is no code violation and it is highly desirable that the smaller breaker be used. I do believe however that all factors which could influence the starting current in the future should be considered. A breaker which operates frequently due to the starting current of the motor becomes a nuisance which often is satisfied by jumpers, intended as a temporary measure which often becomes permanent.

In connection with the new machines, which I assume are factory wired, it is quite possible that some of these machines are covered by the special requirements of Article 670 covering machine tools. Reference to this Article shows some exceptions to specific provisions of Article 430. It is important to note however the definition of a "machine tool" which is covered by Section 6701. Reports recently received from inspectors indicate that Article 670 is being applied to machines other than as described in Article 670. One of the best ways to discourage this practice is for the field maintenance man to report such code violations to the manufacturer, and to advise him of the additional expense involved with rewiring and proper motor protection essential to meet the code standard covered by Article 430 .-B.A.MeD.

Surge Protection

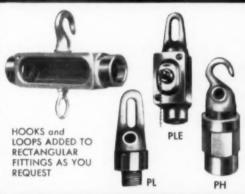
Q. We are planning to submit a bid on a new grain elevator being constructed in this city and

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we note in the electrical specs a provision that the service to this building shall either be run underground or shall be provided with surge capacitors at the point of service if the service drop is run overhead. There are a number of other elevators in this area and none of them are provided with surge protection even though they are all served overhead, so we are wondering if this is some new provision contained in the most recent edition of the National Electrical Code for the first time.-M.C.

No, this is not a new provision in the Code as it has been contained in many previous editions of the National Electrical Code; in fact, I believe it was first included in either the 1935 or the 1937 edition of this code. At the present time Section 5053 contains this requirement and is worded as follows:

"Surge Protection, Class II, Divisions 1 and 2. In geographical locations where lighting disturbances are prevalent, wiring systems in Class II locations shall, if supplied from overhead supply systems, be suitably protected against highvoltage surges. This protection shall include suitable lightning protective devices, interconnection of all grounds, and surge-protective capacitors."

In view of this wording, it becomes necessary for the inspection authority having jurisdiction in your area to determine whether or not weather conditions are such that the frequency of lightning storms justifies compliance with the provisions of this section. It is my personal belief that your entire state of Iowa should be considered as being subjected to prevalent lightning discharges and I certainly would recommend that if this elevator is served overhead, suitable lightning surge or high voltage surge protection be provided as is spelled out under this section of the National Electrical Code.-G.R.

Inductive Heating-AC Systems

The sketch illustrates a split panel to be used for general store lighting, window lighting and signs. We have entered the panel with three No. 4/0 and double lugged with two No. 4 over to the first contactor and then over to second contactor. (The contactors are controlled by time clocks not shown). The contactors are situ-



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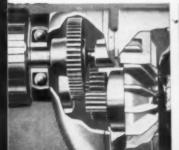
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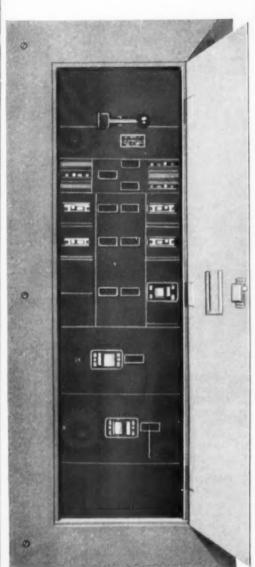




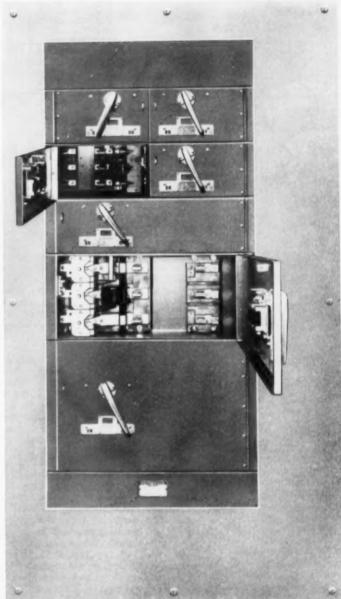
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Type CDP Distribution Panelboard Utilizes E, F, G, J, K, KL, L and M frame AB De-ion circuit breakers; 15-800 amperes. Main lugs up to 1200 amperes—main breakers up to 800 amperes. Service voltages up to 600 volts a-c, 250 volts d-c.



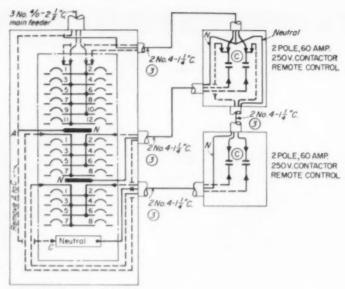
Type FDP Distribution Panelboard Utilizes Type FDP De-ion fusible switch units; 30 - 600 amperes. Main lugs up to 1200 amperes—main switches up to 600 amperes. Service voltages up to 600 volts a-c, 250 volts d-c.



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ated adjacent to the panelboard and we are reducing the wire under code provision 2434. The question is: Does the code require that the neutral be run through the contactors and return to neutral panel? In other words, does the code want three No. 4 wires instead of two No. 4 wires in the conduit shown?—R.P.M.

Section 3018 of the Code re-A. quires ac circuits installed in metal raceways to be so arranged as to avoid overheating of the metal by induction. In order to satisfy this provision in the example covered by your diagram, it would be necessary to run the neutral conductor through each of the 11in. conduits shown, and it would also be necessary to provide a separate neutral bus for each of the three sections of the panelboard. We have noted by the solid lines the necessary corrections on your wiring diagram. It is essential for the unbalanced neutral current for each of the two sections of the panelboard, served through the contactors, to return over a separate neutral conductor through the contactor back to the main feeder .-B.A.McD.

Flexible Conduit— Motor Terminals

Where in the 1953 National Electrical Code may I find the justification of connecting flexible conduit to motors and also of connecting a bare copper jumper across this flexible conduit to assure continuity of grounding, should the flexible conduit connection become loose due to vibration of the motor?—J.D.

Reference to Article 350 covering flexible metal conduit will show that there is no Code provision which denies the use of this wiring method for serving a motor outside the restrictions imposed by Section 3502. One of the principal applications of flexible metal conduit is at motor terminal boxes where a flexible connection is essential for the proper adjustment of motor base frames.

Section 3503, through reference to Section 4439-b definitely recognizes the use of \(\mathbb{\bar{\text{\colorate}}}\)-in. flexible conduit when the motor terminal box is separated from the motor. Section 5014 of the Code also recognizes the use of flexible conduit at motor terminals. I do not believe there is any question with respect to such procedure and field experience indicates that it has been applied for many years.

There are many who believe that a flexible conduit connection at a motor terminal due to vibration and rough usage is not a dependable connection. Re-inspections often show the conduit pulled out of its fitting leaving the motor frame ungrounded. As a result, some Inspection authorities require bonding jumpers to be used around the flexible conduit and I personally believe they are justified in doing so, based on the fundamental concept of safety established by the Code.

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This question was considered early in the year by Panel No. 8 of the Electrical Committee, NFPA and it was unanimously agreed and recommended that the continuity of the flexible conduit should be assured by the use of a bonding jumper. The recommendation was intended to be inserted in Section 4439 of the 1956 Code, but I am unable to find where it has been so recognized. Questions from the field, such as yours, indicate the need for a definite Code provision covering this question.—B.A.McD.

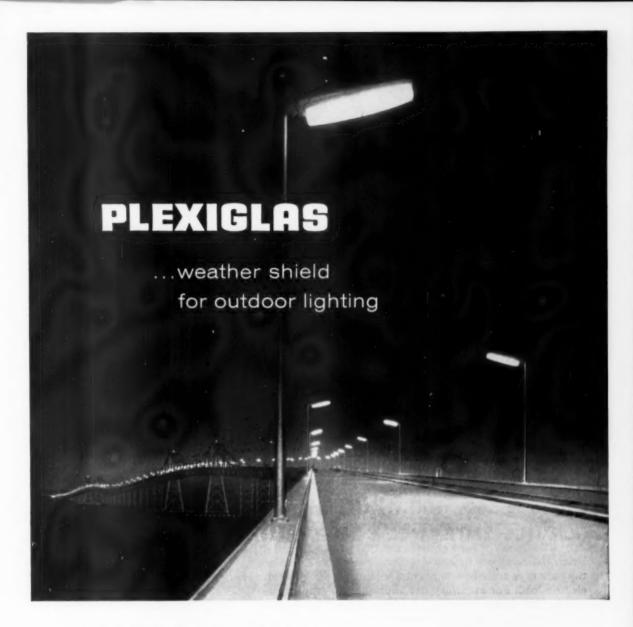
Correction: Status of ACT Armored Cable

In the April 1957 issue of EC&M, the undersigned editor was in error concerning the Underwriters' status of type ACT armored cable. The Code question was answered during December, and advised that ACT was not listed as approved by UL. In the August bi-monthly supplement to the UL construction material list, ACT armored cable was fully recognized by UL. I sincerely trust that this notice will serve to rectify the false impression given.—B.A.McD.

Wiring for a Milk House

Quite a few of the better dairy farms in this area are building new milk houses where they are installing the so-called milk cooling units consisting of rather large tanks where the milk is placed immediately after milking operations are completed and is cooled by electrically operated refrigeration equipment. Is Type UF wire suitable for supplying outlets and these compressor motors in these milk houses, or must we use thin wall conduit with water-tight fittings?—P.K.

The Code would accept either type of wiring as Section 3392 states that Type UF cable may be used for interior wiring in wet, dry or corrosive locations under the recognized wiring methods of this code, and when installed as nonmetallic sheathed cable it should conform to the provisions of Article 336 and shall be of the multiple conductor type. The use of this cable for the supply of ordinary outlets presents no problems. However, where it is used to supply a compressor motor, many workmen are



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not properly supporting the cable between the position at which it leaves an exterior wall or partition and extends over to the compressor unit. This undoubtedly could best be accomplished by means of a short section of metal raceway properly supported and located so it will not be subject to mechanical abuse.—G.R.

Grounding Isolated Systems

Q. Service from the utility company is 440 volts, 3-phase, 3-wire. Inside of the plant there are two dry type, 3-phase, transformers connected to the 440-volt system, and with wye connected secondary, furnishing 208/120-volt current for lighting and small motors.

Should neutral on secondary of these transformers be grounded? Section 2002 of Code seems to prohibit such a system, yet it seems to be in general use.—O.M.R.

The conductor common to both phases must be grounded. It should be noted when only two transformers are used, we do not obtain a complete 3-phase, 4-wire system. As a result, the common conductor is not a neutral conductor and it will carry considerable current when the phase wires are loaded.

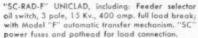
Section 2002 of the Code has, over the past few years, been the source of considerable controversy. As you say, it appears that the grounding of the system you describe would be in violation of this Section. The 1956 revision of the Code clarifies the intent through a new fine print note which reads as follows:

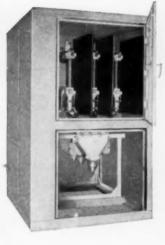
"Electrically connected implies connection capable of carrying current as distinguished from connection through electro-magnetic induction."

Section 2526 of the 1956 Code, which covers the grounding of Isolated Systems, has inserted the word "electrically", so that any question of doubt, with respect to the grounding of such systems, is eliminated.

In other words, a system derived through the use of an insulating type of transformer is not considered to be electrically connected to the primary. A connection through an autotransformer would be an electrical connection. See Page 86 of the Nov. 1956 issue of E. C. & M.—B.A.McD.







Right side opened to show disconnecting type power fuses and ad cable pothead. The pothead can be 3 conductor as shown or 3 single conductor.



Left side panel and cover plates removed to show details of oil switch (with control transformers) and of cable terminating compartment. Also note Model "F" operating mechanism. Oil switches can be furnished for full load break manual operation instead of automatic.

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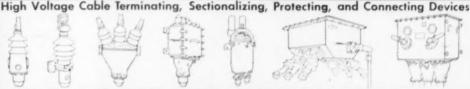












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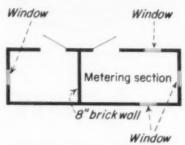


Natural Gas Metering Station

Area A is classified as Class I, Group D, Div. 1. Areas A and B are separated by an 8-in. brick wall. In area B is located a gas fired boiler, telemetering equipment, and necessary telemetering instrument control piping. The control piping is 1-in. in diameter, containing natural gas with a pressure up to 1000 psig. Roof ventilators have been provided in Areas A and B.

1. How would area B be classified?

2. Would relocation of openings between areas A and B alter the classification?—R.O.P.



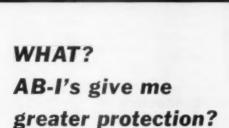
A It would seem that all three specifications set up in Section 5004-b would apply to classify Area B as a Class I, Group D, Div. 2 location.

It is possible that the ventilation would create some draft through the various openings in areas A and B and this might tend to further contaminate area B, but this would have to be determined by actual testing of the system. From this testing it could be determined whether or not the openings should be relocated or even closed up entirely.—B.Z.S.

TW Insulation— Maximum Operating Temperature

Type TW wire, as recognized by the code, has a maximum operating temperature of 60°C. Wire manufacturers for several years have indicated that Type TW wire may have a maximum operating temperature of 90°C. Has the code or UL ever approved this 90°C rating for general purpose installations?—S.W.

A. Section 3102 of the code covers the maximum oper-



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At the present time, neither the

At the present time, neither the code or the UL recognizes thermoplastic insulation, for general purpose installations, with a maximum operating temperature of 90 °C.—B.A.M.CD.

Conductors in Outlet Boxes

Q. We are doing a relighting job in an existing fireproof building where all conduits to existing lighting outlets are contained within the floor slab. In order to provide sufficient capacity for the new lighting, it is necessary that additional circuits be carried through these existing conduit runs. By making use of the extra fill capacity permitted by Table 11 and by using Type TW wire, we will be able to adequately supply the lighting planned. However, the question of the number of conductors permitted in existing boxes is the point on which some disagreement is now existing between us and the local inspector, as we find it necessary in a number of the boxes to use more than the maximum number wires permitted at the present time by the Code; and as they are not changing ceiling height it is impossible to add an extension ring to the existing boxes. What is the rule governing such a situation? -C.A.M.

A the number of conductors contained in outlet boxes attached to conduits which are buried in masonry construction or are embedded in concrete floors are not

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limited as shown under paragraphs a. and b. of Section 3709. You will note a fine print note following this section which reads as follows: "Paragraphs a and b of section 3709 do not apply to conductors used for rewiring existing raceways as referred to in Table 11, Chapter 10."

Inasmuch as no limitation is made, common sense must rule and any inspector would be justified in refusing to accept an installation in which wires were forced into a box by mechanical means.—G.R.

Service Drop Clearance

We have a plan calling for 3-conductor, 500MCM aerial cable from sub-station to building. From sub-station to building it is to pass over a flat top, 1-story building. We are not familiar with the aerial cable, and want to know if the 8-ft clearance must be maintained on this type of cable. Voltage of this line is 480 volts, 3-phase.—O.M.R.

Section 2322-a of the Code requires a service drop, operating at a voltage not exceeding 600 volts, to have an 8-ft clearance over a flat roof. Section 2303-c indicates that a service drop may be in the form of a multiple conductor cable, or as individual conductors. As a result the Code requires the clearances established by Section 2322-a to be satisfied, regardless of the type of service drop used; and there appears to be no exception for the aerial cable you plan to use.—B.A.McD.

Wiring for Fixed Appliances

The owner of several apartments in the city is installing automatic washing machines and driers and has asked us to run the necessary circuits to supply energy to these units. In one of these apartments there will be two washers and two driers and in the other three washers and three driers, and in each case these units will be located at considerable distance from the electrical service making it necessary for us to run a new feeder through the basement to a distribution panel which we will mount in the laundry room. As there are four or more fixed appliances connected to this single feeder in each instance, is it not



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Revere scores again with this outstanding series of Wall and Roof Brackets. They are Superior in Design — Quality and Performance . . . of Heavy-Duty Cast Aluminum Construction and save hours in Installation time through simplified provision for wiring. Available with 1½ inch aluminum arms or with hot-dip galvanized steel arms for mounting Revere Mercury or Incandescent Luminaires. Arms are locked in position with heavy cup-point screws. Roof type arm swings over parapet. Wall type swings back to wall for safe, easy servicing.

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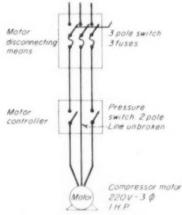
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THE ONLY COMPLETE LINE OF LUMINAIRES - PLODUCIONTS AND POLES FOR STREET - SPORTS AIRPORT - SERVICE STATION - OUTDOOR THEATRE : WASHIELDED INDUSTRIAL LIGHTING possible to use a demand factor of 75% as is shown under Section 2203 of the Code?—O.F.

The Official Interpretation · Committee of the National Electrical Code Committee have ruled that the 75% demand factor given in paragraph e. of Section 2203 cannot be applied where a single feeder supplies only the appliances to which the demand factor would otherwise be eligible. Therefore in your case it will be necessary to use the total nameplate ratings of all appliances connected to this feeder for determining the carrying capacity of that feeder. It was the intent of the code committee in providing for this demand factor that it be applied only to feeders supplying other loads in addition to the four or more fixed appliances other than electric ranges, air conditioning equipment or space heating equipment.-G.R.

Motor Disconnect And Control

Q. I would like to know about wiring an air compressor in a school building. The motor is 220-volt 3-phase 1 hp. We have had some disagreement about wiring it up. The company said that the 2-pole pressure switch could be used to control the motor without disconnecting all three lines from the motor. I thought that the pressure switch should be a 3-pole, or use the 2-pole with a magnetic control to disconnect all three conductors.



Would Section 4384, Article 430, which says the control need not open all conductors, apply to the 2-pole switch?

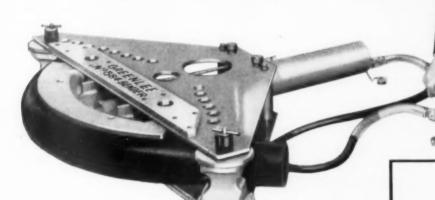
How can a hot line be left connected to the motor when not run-

NEW

GREENLEE 884 POWER BENDER

quickly makes <u>full 90°</u> bend

in 4" conduit with one ram stroke



now – a fast, lightweight hydraulic bender that handles 10 conduit sizes from ½" through 4"...combines the speed and power, the wide conduit size range, and the complete ease of operation that so many contractors have been asking for.

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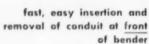
It's extra powerful: Forty tons of ram pressure for easy bending of any of these sizes of pipe or conduit $-\frac{1}{2},\frac{3}{4},\frac{7}{4},\frac{11}{4},\frac{11}{4},\frac{7}{4},\frac{11}{2},\frac{7}{4},\frac{21}{2},\frac{7}{2},\frac{21}{2},\frac{7}{4},\frac{31}{2},\frac{7}{4},\frac{47}{4},\frac{11}{4},\frac{11}{4},\frac{7}{4},\frac{11}{4},\frac{7}{4},\frac{11}{2},\frac{7}{4},\frac{21}{2},\frac{7}{4},\frac{31}{2},\frac{7}{4},\frac{47}{4},\frac{11}{4},\frac{11}{4},\frac{7}{4},\frac{11}{4},\frac{7}{4},\frac{11}{4},\frac{7}{4},\frac{11}{4},\frac{7}{4},\frac{11}{4},\frac{7}{4},\frac{11}{4},\frac{7}{4},\frac{11}{4},\frac{7}{4},\frac{11}{4},\frac{7}{4},\frac{11}{4},\frac{7}{4},\frac{11}{4},\frac{7}{4},\frac{11}{4},\frac{7}{4},\frac{11}{4},\frac{7}{4},\frac{11}{4},\frac{7}{4},\frac{11}{4},\frac{7}{4},\frac{11}{4},\frac{7}{4},\frac{7}{4},\frac{7}{4},\frac{7}{4},\frac{7}{4},\frac{7}{4},\frac{11}{4},\frac{7$

It's a timesover and a money-maker for you: Eliminates need for costly manufactured bends and fittings . . . cuts job time to a fraction. Pays for itself over and over again.

SEE YOUR ELECTRICAL DISTRIBUTOR for complete details on this timesaving new GREENLEE No. 884 Hydraulic Power Bender for conduit up through 4", or write for illustrated bulletin No. E-224.



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If you need to protect electrical wiring against liquids and dirt, this new oil-tight sectional Wireway is just what you are looking for. Neoprene gasket on hinged cover and between sections assures a tight seal. No holes or knockouts.

This Wireway simplifies your entire installation problem. It is easy to bolt together and take apart. Hinged cover opens full length making it easy to install wires and easy to change or modify wiring scheme after installation.

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"EFFICIENCY" DEVICES for CONDUIT and CABLE SUSPENSION



ning, and still comply with Code?

As shown by your illustra-A. tion. I assume that the 3pole, fused switch is the disconnecting means for the motor and complies with all of the pertinent provisions of Section 4401 through 4411. The 2-pole compressor switch is the motor controller and I assume it satisfies Code sections 4381 through 4390. If this assumption is correct, we have two separate components of a motor branch circuit, and the Code provisions vary as follows:

Section 4406 requires the motor disconnecting means to disconnect both the motor and the controller from all ungrounded supply conductors. If one of the phase conductors was grounded, a 2-pole switch would satisfy this Code provision. In other words, all of the live conductors feeding the motor must be disconnected when the switch is in the open position.

Section 4384 does not require all of the live conductors to the motor to be disconnected, and Section 4382 merely requires that the controller is capable of starting and stopping the motor. In the case in question, this is satisfied when the 2-phase conductors are disconnected

As a result of the above code rules a motor, not in operation, may have a live conductor at the motor when the disconnecting means is in a closed position, and the code fully recognizes this condition and has recognized same for more than 25 years. I believe the principal objective of the motor disconnect is to provide a means of disconnecting all ungrounded conductors to both the controller and the motor, so that maintenance may be made without hazard to the electrician. This is evident since automatically controlled motors usually remain connected to the line through their controllers until maintenance or other unusual conditions require the use of the disconnecting means. -B.A.McD.

Sealing Fittings

On a 2-in. or larger conduit run, is it no longer necessary to provide sealing fittings within 18 in. of each enclosure or fitting which contains only a splice or tap when such installation is located in a hazardous Class 1 area? -M.M.

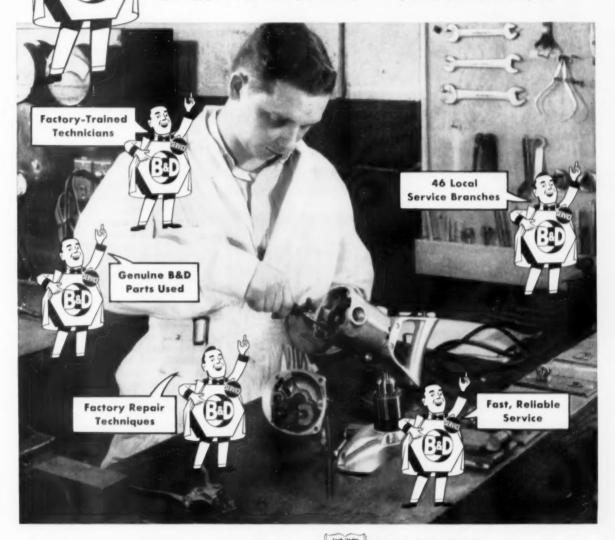
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No. the code no longer re-· quires that seals be used in 2-in, or larger conduit adjacent to a fitting or enclosure which contains only a splice or tap. In fact this provision was withdrawn from the 1953 edition of the National Electrical Code and was contained last in the 1951 edition, and the current edition of the code requires seals only within 18 in. of enclosures for switches, circuit breakers, fuses, relays, resistors, or other apparatus which may produce sparks, arcs or high temperatures or where each conduit run leaves or enters a hazardous location.-G.R.

Splices in Condulets

In rigid conduit work, may splices be made in condulets, such as pull fittings, "T's" or "LB's"? I am referring especially to splices in "T's" to take off with a lamp arm from, say a \(\frac{1}{2}\) or \(\frac{1}{2}\)-in. run of conduit used for a lighting circuit in grain elevators and warehouses. I know it is being done and makes a very neat and safe job in dusty areas, but cannot find any article in Code regarding it.—J.W.

"Condulets" which is a A. trade name of the Crouse-Hinds Company are listed by Underwriters' Laboratories under the general heading of "Outlet Boxes and Fittings". Article 370 of the Code also covers "Boxes and Fittings". There are various types of outlet boxes, such as those designed with clamps for use with cable assemblies, the locknut and bushing type, and boxes provided with hubs. "Condulets" are provided with hubs designated as "threaded" or "threadless". Section 3709 of the Code limits the number of conductors which may be installed in a box, and paragraph "e" of this Section advises that the limitations given, do not apply to boxes with hubs. This Section of the Code intimates that "condulets" such as the T's and LB's you mention are considered to be boxes and may be used as such with splices as the occasion may require. I do not believe there is any Code violation in the application which you have outlined except as follows:

Grain elevators usually are classed as hazardous locations and come within the Scope of Article 500. If the application in question is considered to be a Class 2, Division 1 location, boxes in which taps, joints or terminal connections are made shall be dust-ignition proof



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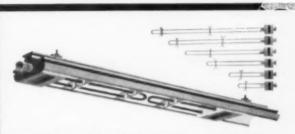
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For single assembly or in banks. Two bolts in sliding clamps facilitate mounting; two wires to connect. Six standard lengths, 14 standard wattages. Housing is rigid extruded aluminum with brightly polished parabolic non-oxidizing reflector. Write for Bulletin C5-604.



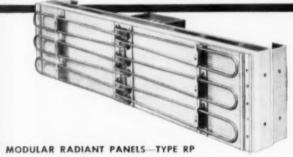
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EASY LINK REPLACEMENT, requiring only a screwdriver and a few seconds' work. Screws holding link have nuts locked in position. Sturdy tubular bridge assures perfect link contact and knife alignment. You don't need a lot of parts —

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and approved for a Class 2 location. This Code provision eliminates the use of condulets in such a location and boxes specifically approved by Underwriters' Laboratories for a Class 2 Division 1 location must be used. See Section 5054.—B.A.M.CD.

Floor Receptacle

When a floor receptacle is placed in the center of a dining room, may that receptacle be counted in determining the total number of receptacles required in such a dining room? This is, of course, contained within an ordinary dwelling.—O.F.

A b. of Section 2124 specifically states that receptacle outlets in floors shall not be counted as a part of the required number of receptacle outlets unless those outlets are located close to the wall. As one can hardly count an outlet located in the center of the room as being close to a wall, this outlet could not be used in determining the minimum number of outlets required by this section.—G.R.

Tentative Interim Amendment No. 108

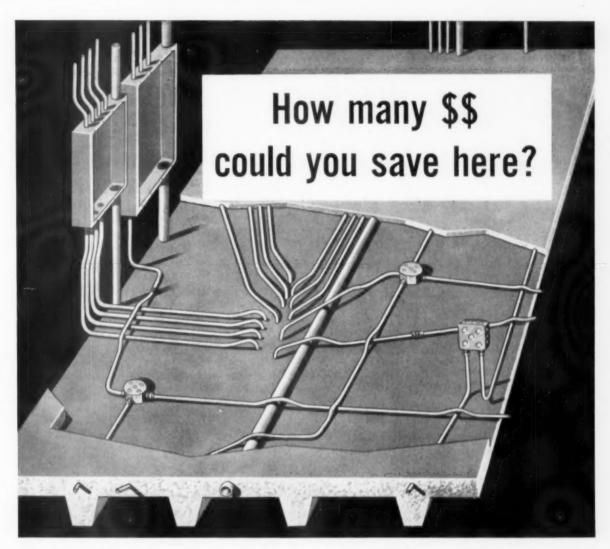
(Effective March 14, 1957)

Tentative Interim Amendment No. 108 to the 1956 edition of the National Electrical Code has just been released by the National Electrical Code Committee of the National Fire Prevention Association.

The amendment modifies the last sentence of Section 3856 of the N.E.C. to read as follows:

"Insulated conductors used for instrument and control wiring on the back of switchboards shall be flame retardant, either inherently or by means of an outer covering, such as one of the following types: R, RH, RW, RHH, RHW, V, AVA, AVB, T, TA, TW, MI, or other types specifically approved for the purpose."

Developed under the published Procedure for Tentative Interim Amendments, it is recommended by the Committee for application in the administration of the 1956 edition of the National Electrical Code and is recorded on the docket of the N.E.C. Code-Making Panel No. 9 for further consideration by that Panel with regard to the next revision of the Code.



A careful look at any job might turn up a dozen money-saving ideas. But let's take just one operation—the time and skill required to produce uniform bends. With General Electric EMT your men can produce offsets, stubs, saddles, and sharp radius bends like these on the first try. There's no kinking, flattening, or splitting, no lost motion or time in normal handling.

G-E EMT handles easily because it's made of the finest cold-rolled steel. And the continuous induction weld, exclusive with General Electric EMT, means no splits or burrs. The results: Your crew does the job faster and there's less material waste. Unnecessary installation costs are avoided.

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Wiring a steel, chemical or refrigeration plant? Or other areas where corrosion is unusually severe? General Electric EMT with plastic coating provides long-lasting extra protection against acids, alkalies, water and humidity—effectively withstands grease, oils, organic solvents. It's easy to bend, too, and offers excellent resistance to impact and abrasion.

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Diversity Keeps Work-Level High

Standard Electric Service Corporation of Reading, Pa., believes in comprehensive and diversified repair activities. Therefore their shop handles motors for residential as well as for commercial and industrial applications; they work directly for industrial and business firms as well as through local service shops and contractors; they have facilities that permit repair work to be completed on customers' premises as well as in their own shop, and the size of motors thus handled ranges from 1200-hp drives down to fractionals for oil-burner or stoker assemblies.

Motor-exchange and discount policies for contractors are used as inducements to promote additional work, while efficiency in the shop is promoted by adopting production-line methods whenever practicable. Standard procedures include complete inspection of a motor upon receipt; thorough testing before it is returned; charges determined on a straight T&M basis, and work orders prepared in duplicate. In this latter case, all

basis, and work orders prepared in duplicate. In this latter case, al

DUPLICATE work orders are filled out as soon as a motor is received in the shop for repair. Original copy, saved for the office file, contains notations concerning winding data, materials used, etc., while carbon (customer's) copy contains brief description of the nature of the trouble, for the customer's general information.

rewind, parts and material data is noted on the office copy for subsequent reference, while a brief general description of the work is noted on the customer's copy for his information.

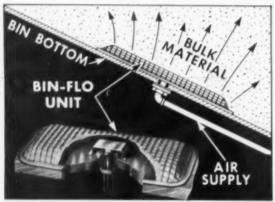
Another standard procedure with Standard is the attachment of a "Comments" slip to each motor being returned to a customer, typical comments including remarks such as "this motor should not be used for (such and such) application", or "unit has been receiving too much (or wrong type) of lubrication", or "condition of insulation indicates that this motor is being overloaded excessively" or — in many instances—"this motor is being returned in first-class oper-



EACH MOTOR or electrical tool, appliance or device received in the shop is assigned a bin number, and all parts and materials related to the repair of that item are placed therein to prevent loss or confusion. Bins of various sizes provide storage space for majority of items brought in for inspection and repair.



REPLACEMENT parts are conveniently stocked in bins identified by progressive letter-number system. Rapid selection of items is possible since items are either plainly displayed in an unwrapped condition, or the cartons or boxes containing small parts are stacked in bins having additional front-lip data.



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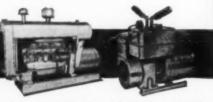
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ating condition". Many of these comments have proved helpful to the customer in his maintenance or application habits, and many, also, have led directly to the purchase of a new motor.

Spray Booth Reveals Practical Planning

Paint spraying in the shop of the Buffalo Electric Company is performed in a booth where equipment and controls are logically grouped for easy, speedy operation. As indicated, several spray guns -each equipped with a separate metal quart container holding a different color-are conveniently hook-suspended from the forward over-hanging lip of the booth hood while, directly below the guns, an air supply hose is fitted with a snap-on coupling that facilitates fast, effortless changes and positive connections between the hose and the various gun nozzles. Pressure dials and air pressure controls are likewise conveniently grouped at shoulder height for easy reading and regulation.

This booth is metal lined, illuminated by vaporproof incandescent lighting fixtures, and equipped with a high-capacity exhaust fan and duct installation that efficiently carries paint spray first downwards, then up and out of the all-brick fireproof building. Since the booth is located closely adjacent to dip tanks, ovens, burning booth and scrap-wire bins, handling of units as they move from one service area to another is minimized greatly.



SNAP-ON COUPLING at end of air hose makes connections with spray guns that are fast, easy and positive. Separate spray gun and container is used for each color by the Buffalo Electric Co.



Pattern No. 70 glass in New Trier Township High School cafeteria. General Contractors: John Griggiths and Sons Construction Company. Fixtures by Electro Silv-A-King.



Pattern No. 70 glass in Hudson Falls High School Library. General Contractors: Consolidated Construction, Inc. Fixtures by Sylvania.



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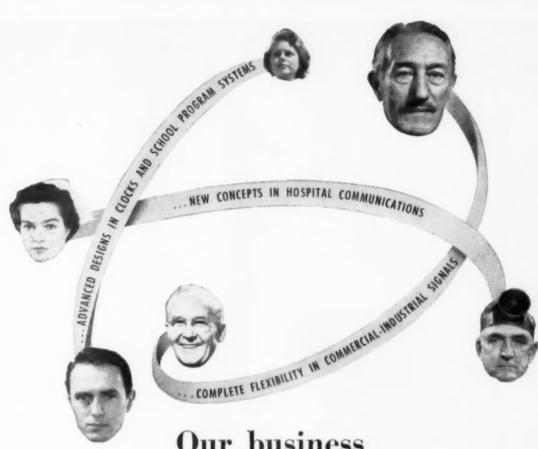


Galvanized Tubes Provide Storage Space

Tubes, wedges and slot sticks are stored compactly and conveniently in shop of Standard Electric Co., Reading, Pa., where 5-in. diameter galvanized tubing is used in conjunction with a sheet-metal base plate. Tubes shown measure approximately 3 ft in height, and each tube is plainly numbered to identify the material contained therein. When lengths of stored materials are shortened to point where items no longer protrude above rim, they are stored in shorter adjacently placed tubes which are likewise identified by numerical index. Tubes are welded to base-plate to prevent tipping, and dust, dirt and debris can be easily removed from tubes by turning entire assembly upside down.



CARL W. RUCKER, shown here in front of the test bench, heads up operations at Rucker Electric Motor Repair, Paramus, N. J., maintaining a modern, up-to-date shop to handle industrial, contractor and service accounts in the winding and repair of all types of ac and dc motors.



Our business is communications



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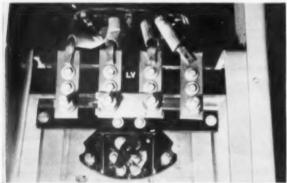
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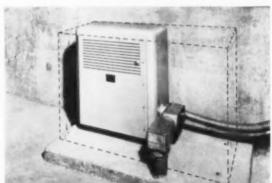
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Father Thomas Moore Newbold, Rector of the seminary, with Roger Markland, Mack Electric Company, St. Louis. Architects: Smith, Hanlon, Zurheide, Levy, Inc.



Tap changer permits secondary voltage correction in seconds—a twist of the wrist now adjusts secondary voltage for changing load conditions—a Westinghouse exclusive.



This quiet DT-3 transformer is installed directly beneath the living quarters of the seminary priest. Outline shows space provided for the previous transformer design!

NEW 3-phase dry-type transformer



DESIGNED TO TEST BELOW 45 DECIBELS ... UP TO 51% SMALLER, 32% LIGHTER

Silence is the watchword for equipment at the Passionist Fathers' Mother of Good Counsel Seminary near Warrenton, Mo. The Westinghouse Type DT-3 transformer not only meets this basic requirement, but its new, smaller size cuts installation, operating and maintenance costs.

Lower sound levels. Core-coil assembly floats on a mechanical vibration dampening system, independent of case, base and connecting conduit, reducing noise levels 15 decibels or more below NEMA standards.

New compactness, greater efficiency. Two Westinghouse exclusives—inorganic Silclad insulation and grain-oriented Hipersil® steel cores—cut transformer size 25-51%, weight 17-32% over previous Class B 80°C rise units.

New, lower installation costs. These compact, easy-to-handle units save space, are quickly mounted overhead near load centers, shortening secondary leads, One DT-3 costs 36% less to install than three single-phase transformers (according to published N.E.C.A. data).

Low case temperatures, trouble-free performance, longer life.

Case temperatures are no higher than 80°C rise units, lower than Underwriters' Standards. Reduced heat means additional savings in longer component life, greater overload capability.

For complete information on the DT-3 transformer, call your local Westinghouse salesman or distributor...or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa.

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If your plant is a victim of undervoltage, it's time to **POWER-UP.** Ask your Westinghouse representative or your utility power sales engineer for specific recommendations to fit your problem.

The quiet performance of this 75-kva, Type DT-3 transformer was a major factor influencing its installation in the seminary's high school. Reading taken twelve inches from the unit showed a sound level of 42 decibels—18 decibels below NEMA standards.

New pressure-splice method insulates even this complex splice!



"SCOTCHCAST" pressure method has widest application range of any insulating system!

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container holds the laboratory - correct mixture of "SCOTCHCAST" Resin No. 4 to make a fast, factory-quality splice in the field. This new Pressure-Splice method affords the utmost in excellent physical, electrical and moisture protection-consistent-

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THIS new 3M Pressure Gun makes the "SCOTCHCAST" method practical, simple, and positive for any type of field splice where the size, shape, position, or inaccessibility of the splice make other splice insulating methods difficult. This gun was specially designed for the

ly, splice after splice — with any combination of new Pressure-Splice method; makes insulating splices a neat, clean, quick, and permanent job.

SEND FOR complete information on the new "Scotchcast" Pressure-Splice method for field use. Just write on your letterhead to: 3M Co., St. Paul 6, Minn., Dept. CB-67.

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In The News

"Wheels of Progress" is Theme of NISA's 24th Annual Convention

More than a thousand NISA members guests and manufacturers' representatives converged upon Buffalo, N. Y., May 12th, to attend the 24th annual convention of the National Industrial Service Association. And, following the nowfamiliar pattern of former NISA meetings, the 4-day conclave was a jam-packed period of formal addresses and informal forums, visitations to shops in the area of the convention city, a "biggerthan-ever" exhibition of shop equipment and materials, plus an active social program that left delegates contentedly "tired but happy."

The convention also marked the election of Alfred Elson, Jr., New England Machine & Electric Company, Pawtucket, Rhode Island, as national NISA president for the coming year, together with a vice president-secretary-treasurer slate that included Paul Sievert, Sievert Electric, Chicago; H. C. Blenkhorn, Blenkhorn & Sawle, St. Catherines, Ont.; and Frank W. Ross, Ross Electric Motor Shop. Fairmont.

Still another feature of the program was the awarding of 14 cash prizes to winners of the Association's annual "shop idea" contest, first prize this year going to George E. Adams of Sandman Electric in Boston for his submission of a scheduling board whereby jobs "in the shop" could be followed closely as they progressed from initial receipt to final delivery.

Minn., respectively.

One of several presentations meriting special comment was delivered by R. B. Turner, Johnson-Turner Electric Repair and Engineering Co., Windsor, Ont. Taking the provocative title of "Why is a Manager-and How?", Turner analyzed techniques of executive leadership, principles of management. and many recommended business management procedures, stating that technical ability, job ability and professional ability are entirely different from managerial ability, and that outstanding craftsmen, technicians, engineers and accountants are not necessarily

good managers unless special training is included. He also stressed the point that a good manager must learn to delegate responsibility to others, for today diversity, complexity and magnitude of business have resulted in legal controls and limitations, government requirements, labor requirements and competitive problems that are far too expansive for a single person to cope with successfully.

In this discussion. Turner stated further that good leadership demands self analysis, a streamlined mind, a pleasant personality, the ability to speak effectively, good reading habits, the ability to conduct conferences and interviews and the art of psychology. He also stated that management has the responsibility for planning, organization, delegation, supervision and co-ordination, and that every decision should be governed by such self-imposed questions as Is it the truth, Is it fair to all concerned, Will it build good will and better friendships, and Will it be beneficial to all?

In his comprehensive treatment of this subject he also discussed the organization of a business enterprise, detailing the responsibilities of department heads concerned with such activities as



CONVENTION General Charman Henry Lang, Lang Electric, Buffalo, and his cachairman, Glen Frosdick, Dynama and Motor Exchange, also Buffalo, received many hearty congratulations concerning this year's active, interesting and stimulating 4-day session which was staged in their home city May 12-16.

electrical repair and service, electrical contracting, sales promotion and accounting.

Keeping Pace With Progress

Another thought-provoking discussion was presented by NISA's president-elect Al Elson, who took as his subject "Progress-What are YOU doing about it?" Citing many of the trends which are resulting in increased repair business, he inquired whether NISA members were doing any long range planning; were their facilities adequate; are their methods up to date; are they prepared to properly service motors that require rewinding in glass, silicone or epoxy, and are they prepared to service foreign-make motors. Each of these questions was then analyzed in detail and numerous practical suggestions for improving shop service were suggested, including 49 modern items of equipment which one would expect to find in an up-to-date 3-phase motor department, plus 18 additional items which should be part of the equipment in a progressive singlephase shop.

Elson stated that one of the greatest weaknesses in the motorrepair business is lack of management progressiveness, emphasizing the fact that this industry was built on service and that only by giving better service can the industry prosper. This means better training of personnel, the best equipment available and alert management. That progress is being made along these lines is indicated by the fact that, during the past year, more new facilities have been built or enlarged than in the past five years, and that more facilities have been added or improved since the end of World War II than in the previous half-century.

Along the same general line, Clair Dean, vice president of the Buffalo Electric Company, declared that "A Better Mouse Trap is Not Enough" for, today, without public relations and advertising, few customers would seek you out, regardless of the merit of your work.



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moral: IT JUST MAKES GOOD DOLLARS AND SENSE TO USE IDEAL "WIRE-NUTS" ON ALL YOUR WIRING JOBS.

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Good work is naturally essential, he said, as are the best materials obtainable, high-quality workmanship, modern methods, good testing facilities and good morale. Equally important for success, however, are complete honesty with your customers, good business practices with your suppliers, a high order of service, and progressive, constant selling.

C. E. Sutton, Jr., manager of marketing for service shops, General Electric Company, also spoke on the subject of "Service for Sale," estimating that approximately 350 million fractional-hp motors are in service today and that about 725 million fractionals will be newly produced during the next decade. If each of these motors demands \$10 worth of service or by-products annually, the repair shops of the country can look forward to more than a 20% boost in work within the next ten years. Sutton then offered many practical hints for effective selling and promotion, market research and product planning, advertising and realistic pricing of sales and services, emphasizing that the service operator today must continually review his pricing structure to make certain that the level is such that sufficient profit is available to finance expansion and to cover raw materials, direct labor, overhead, selling and administrative expenses, taxes and other equally important factors.

Still another paper reiterating the fact that "Nothing Happens "Til Someone Sells Something" was presented by Fred Powers, assistant general manager of Century Electric, St. Louis, Mo., who stated that shops should inform potential customers of all their service and sales facets through personal calls, newspaper or radio advertisements, direct mail, products displays, participation in civic activities and the like. Profitable sidelines to a motor-repair business could easily include service and sales of small electric cranes and hoists, a good pump line, V-belts and pulleys, controls, refrigeration compressors. hand power tools, hermetic windings and so on, he added, stressing the point that a service enterprise prospers only by broadening the scope of its services, establishing a reputation for good, prompt, reliable and reasonable work.

A Look at Transformers

Revealing the results of a recent survey concerning transformer repair work performed in large NISA

(IDEAL)



COMMITTEE CHAIRMEN Ralph Barker, Barker Electric, Niagara Falls (Transportation), and Al Volland, Volland Electric Equipment, Buffalo (Special Events), were caught during one of the very brief moments when they were "taking a breather" during the 4-day meeting.

shops, George Larsen, Larsen-Hogue Electric, Los Angeles, stated that (1) over 75% of the transformer business being done in these shops comes from companies that generate or distribute power, while the remaining 25% comes from industrial power users; (2) about half of all transformer business is in rewinding, while 35% is in recoring and the remaining 15% is in overhaul and clean-up work; and that (3) recoring work, in itself, is unprofitable unless a large volume is involved. One large shop, Larsen said, estimates that this break-even point of volume is around 400 transformers a month. while another shop placed the volume level at about \$50,000 per month.

Larsen posed the question of whether NISA shops, generally, were assuming their legitimate responsibility in servicing transformers, inasmuch as only 29% of the Association's membership includes this service at all, and only a very few do a sizable volume of work in this category. He also wondered whether NISA shops were missing a good opportunity by ignoring this work for, with industrial plants buying primary power at higher voltage levels, industrial power-distribution transformers are constantly increasing in numbers. Industrial plants are also good sources for obtaining work related to welding, furnace, battery-charging, plating rectifier, and many miscellaneous reactor transformers as well, plus cores for induction heating transformers, magnetic separators, lifting magnets. autotransformers for reduced voltage starters, and so on.

"Electrical Insulation of the Present and Future" was the topic



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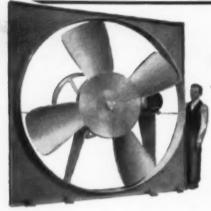
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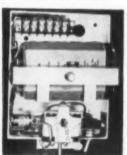
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Photo showing 8 in. bell of LIFE SAVER SR. MODEL CI

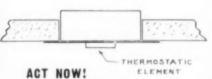


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discussed by Jack Wilson, chief physicist for the Louis Allis Company in Milwaukee, and, in this absorbing analysis, he discussed a new water-reducible resin which not only presents a high order of chemical stability, but also offers the means of eliminating costly organic solvents and fire hazards. Wilson also reviewed the development and potential of the acrylate resins, auxiliary insulation materials manufactured with Lecton. polyester insulating materials, polyurethanes and isocyanates, also the epoxy family. Creative engineering in electric motor design is the result of the combined efforts of chemists, physicists and electrical engineers who are able to pool their resources and bring highly specialized knowledge into the development of manufacturing techniques, he stated, adding that all of these efforts result in the design of equipment which has less weight, smaller size and improved horsepower ratings.

Another interesting discussion concerned "Brush Abuses," presented by F. E. Wrikeman of the Superior Carbon Products in Cleveland. Generally speaking, he stated. 95% of all trouble calls concerning brushes are based upon one or more of seven basic classifications, these being faulty spring tension, faulty brush holder spacing, mixed grades of brushes, excessive commutator cleaning, excessive dirt or oil or metal dust or atmospheric contaminants, high mica or mica fins, and off-neutral operation. Each category was then examined in detail and recommendations were prescribed for eliminating or reducing these sources

of trouble.

Electronics and Taxes

Two additional presentations, closely allied to the motor-repair field, were presented by A. R. Murphy, application engineer for Reliance Electric and Engineering Company, Cleveland, and by Robert O. Swados, attorney at law in Buffalo with the firm of Cohen, Swados, Wright and Hanifin. Murphy's paper discussed "Industrial Electronics", while Bob Swados took the intriguing title "How to be a Happy Taxpayer" for his subject.

Basing his remarks primarily upon electronic control of dc drive motors, Murphy mentioned the resurgence of dc motors in the industrial drive picture due to the ability of dc motors to be completely con-

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trolled and to do precisely what is required of them. He mentioned that control of such motors and drive systems takes two forms, the first involving a system in which ac power is converted to dc for the drive motor through a rotating m-g set, whereby electronics is used to control the field of the generator or the drive motor or both, and the second way in which electronics is used is to supply armature power to the motor directly through the use of electronic tubes operating from the ac line.

During the course of his paper, Murphy showed why electronics have a distinct and important place in the motor control picture; how the evolution of industrial electronics has now resulted in excellent results from the standpoint of reliability, simplicity and ease of maintenance; and what seems to be coming up in this general field and what we can expect to see in the way of new equipment in the near future. On the latter subject, he stated that developments are coming fast which may make it possible to eliminate many of the electronic tubes now seen in our industrial regulators, and that germanium and silicon diodes and transistors are being developed at a rapid rate to the point at which they may be suitable for inclusion in industrial systems. He also predicted silicon transistors with good life and temperature characteristics which will replace many of the vacuum tubes presently being used. although the elimination of Thyratron tubes in the immediate future is less likely because none of the devices under development appears to be suitable for this replacement job.

As to How to be a Happy Taxpayer, Swados advised conference delegates to keep adequate records. have a tax "awareness" in all their business transactions, and employ and use competent advise. Swados admittedly did not completely cover his subject, for, as he stated, "the Internal Revenue Code of 1954 was 984 pages long; reports of Senate and House Committees were another 600 pages, and during the past three years approximately 2700 pages of rulings and regulations have been issued on this subiect." He did, however, offer many useful suggestions for legitimately reducing taxable items by considering such things as capital gains. corporations vs partnerships, reporting income on a percentageof-completion vs a totally complete basis, or on an accrual rather than



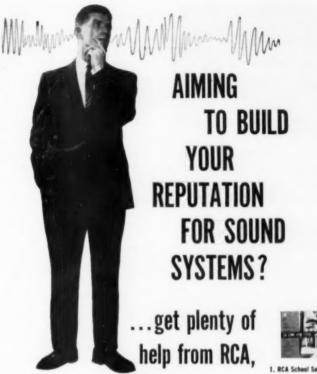
PAST PRESIDENTS Joe Previty, Penn Electric Motor Company, Philadelphia (1955-56), and Bill Wheeler, Sr., The Maintenance Company, New York City (1937-38) found that reminiscences concerning past mutual experiences of that office provided a pleasant interlude between sessions of this year's busy convention program in Buffalo,

a strict cash basis. He also mentioned that customers' interests should be considered as well, citing the fact that "repairs" are immediately deductible, whereas "replacements" can be deductible only over a longer period, and that most customers would therefore prefer the first-named billing designation if there is a reasonable doubt concerning the extensiveness of a repair job.

Velocity of Progress

As keynote speaker, Rob Roy MacLeod, president, Niagara Mohawk Power Corporation, Buffalo, emphasized the swift pace or velocity that progress is recording, illustrating his point by citing growth curves in the fields of electrical generation and consumption, public acceptance of electrical devices and appliances, motorization and automation, horsepower-perworker and per home-owner and the like. He also stressed the mobility of present-day industry, due to the fact that distribution lines now place power at the disposal of all industrial users, eliminating the former necessity of locating a plant close to a waterfall, a coal field or similar source of power. He also echoed the theme of the convention by implying how the Wheels of Progress move only through the meshing of such geared mechanisms as materials, personel, equipment, trade practices, customer relations and management of indus-

All of the foregoing talks were presented at various general and technical sessions, each one being called to order by Henry Lang, Jr., Lang Electric, Buffalo, General Sessions Chairman, who then intro-



the leader

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duced and turned the several meetings over to Day-Session chairman Larsen-Hogue William Hogue, Electric, Los Angeles; G. E. "Ed" Jones, G. E. Jones Electric, Amarillo, Texas, and Alex A. Shoven, Industrial Electric Service, Hawthorne, N. J. All of these technical sessions were held in the mornings, while afternoons were devoted to open forums in which moderators, panels and delegates swapped information, questions and answers concerning small shops, winding materials, transformers, tax laws and insurance, industrial electronics and large motors. Also scheduled for afternoon presentation was the repeated showing of color slides of NISA shops by Paul Sievert, Sievert Electric, Chicago, which proved to be a convention highlight.

Cash Prizes for Shop Ideas

In the annual Shop Idea contest, first prize of \$100 went to George Adams of Boston, as previously mentioned. In addition, a second prize of \$75 was awarded to Henry Brown of Snow Electric, Winston-Salem, N. C., for a device for handling motors with eye-bolts missing, while third prize in the amount of \$50 went to Fred Junger and Donald Gould of Industrial Electric Service, Hawthorne, N. J., and a fourth prize of \$25 went to Ed Chamberlain of the same firm. Twelve other awards of \$10 each went to E. J. Hill of Reliable Electric Sales & Service of Woodstock. Ont.; Sidney Lebowitz of Nutmeg Electric Motor Company, Hartford, Conn.: Kenneth Juckett of New England Machine and Electric Company, Pawtucket, R. I.: Henry Martin of White Electric Service in Lowell, Mass.; F. W. Finkernagel of Electric Motor Repair Service in Newark, Del.; David Raynor of Industrial Electric Service, Hawthorne, N. J.; B. V. Ferrari, Jr., of Excel Electric Service, Chicago; George Williamson, Jr., Lang Electric, Buffalo: Charles Bryan of Lockwood's Electric Motor Service in Trenton, N. J.; and to Jim Anderson of A & P Electric in St. Paul, Minn.

One additional prize of \$25 also went to the Industrial Electric Service Company of Hawthorne, N. J., for having the most number of separate entries in this contest which is designed to encourage invention and exchange of better electric motor, generator and transformer service procedures and tools. Contest judges included Ed-

win E. Kolhonen of Peabody Electric Motor Service in Peabody, Mass.; T. M. Paul of Paul Electric in Sioux City, Iowa; John G. Persson of Electric Apparatus and Repair in Philadelphia; Frank W. Ross of Ross Electric Motor Shop in Fairmont, Minn.; and Alex Shovan of Industrial Electric Service, Hawthorne, N. J., who served this judging commission as its chairman.

For committee meetings, social events, exhibition features and other highlights, see reports in our April, 1957, issue on page 59 and page 75.



L. E. Barrett Receives McGraw Award

The Electrical Distributors Medal and Purse under the James H. Mc-Graw Award for Electrical Men was presented to Lester E. Barrett, president, Barrett Electric Supply Co., St. Louis, Mo., on May 28 at the annual convention of the National Association of Electrical Distributors in Washington.

Mr. Barrett received the award for his leadership and influence in encouraging the active participation of his fellow distributors in forwarding the broad goals of adequate wiring nationally and locally.

The judges who recommended Mr. Barrett were D. Lyle Fife, Fife Electric Supply Co.; R. M. Johannesen, Johannesen Electric Co., Inc.; J. M. Newton, Sr., Oakes Electrical Supply Co.; and Titus B. Schmid, Crescent Electric Supply Co.

John M. Newton made the presentation for the Committee of Awards of the James H. McGraw Award



NEW JERSEY NISANS at annual conclave in Buffalo included Milt Burner, Electric Service Repair, Paterson, and Ernie Olson, Olson Electric, Union City.

NALMCO Holds 4th Annual Conference

The National Association of Lighting Maintenance Contractors met in Kansas City, Mo. on April 29-May 2 for its fourth annual conference. In attendance were representatives from 27 of its member firms, plus representatives from the lamp manufacturers and several members' wives, for a total registration of approximately fifty. Business sessions occupied the three days of the conference, and one evening was devoted to a reception and banquet by the entire group.

The NALMCO group is young, and small. It is now in its fifth year. Its total membership is only 29 firms. But NALMCO now has several applications for membership pending, and interest in this association is growing. A big reason is the quality of its convention programs, with top speakers covering highly important subjects, which are of major interest to the firms and their management in this young and virile service industry.

The fourth annual NALMCO conference divided the program of its three-day meeting about equally between business sessions, dealing with association problems and problems faced by its members, and informative and inspirational talks by leaders from other industries. All sessions were chairmanned by Edward I. Creed, NALMCO president

Three of the speakers on the program were from the three major lamp manufacturers, General Electric, Sylvania, and Westinghouse. Richard Lundgren, of the Large Lamp Department, General Electric Co., Nela Park, discussed sales planning and sales tools for lighting maintenance contractors. R. M. Smart, midwest Regional Sales En-

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TO FIT YOUR NEEDS IN INTERCOMMUNICATIONS AND SOUND

PLAN 1



Kellogg's practical push-button telephone system. Pick up the receiver, press a button, and talk. No operator or switchboard. Individual ringing. Conference facilities. A low cost system of excellent quality.

PLAN FOR 6 TO 50 PERSONS

The Select-O-Phone Telephone System. Any number of calls can be made simultaneously. Every station a master station; anyane can dial anyone else at any time. Complete privacy. Conference facilities. Executive right-of-way. General call. Central dictating.

PLAN 3



Kellogg Relaymatic. A complete, private, automatic, telephone system of the same high standards as those used by public telephone companies. No operator. Automatic ringing. Any number of lines can be added at any time.

PLAN

FOR VOICE PAGING ANNOUNCEMENTS, MUSIC, ETC.

Kellogg's Sound Equipment. A complete line of amplifiers, projector horns, and loud-speakers. The finest high fidelity sound equipment available. For any location; outdoors, assembly halls, corridors, factories, warehouses.

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FOR COMBINING
INTERCOMMUNICATIONS
AND SOUND

Kellogg's combination intercommunication and sound installations allow you to make loud-speaker announcements using the telephone instrument on your desk. Simply dial a certain number, and talk. Simplifies and speeds voice paging.



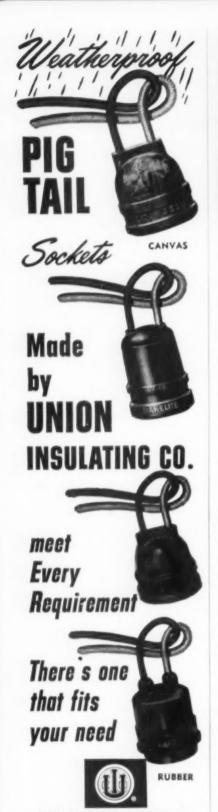
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A Division of
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QUALITY COMMUNICATIONS SYSTEMS
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ELECTRICAL CONSTRUCTION AND MAINTENANCE . . . JUNE, 1957



UNION INSULATING CO.

PARKERSBURG, WEST VIRGINIA



OFFICERS of National Association of Lighting Maintenance Contractors (NALMCO) for the 1957-58 fiscal year, elected May 1 at annual conference, are (1 to r): Southern VP—Malger H. Gray, Tampa, Fla; Eastern VP—Sam Feldman, Allston, Mass.; President—Glen Shatola, Milwaukee, Wis.; Central VP—Edward I. Creed, Cleveland, Ohio; Far Western VP—Gerald Joseph, Albuquerque, N. M.; Midwestern VP—Elmo Irwin, St. Louis; Secretary-Treasurer—R. E. Watson, Denver.

gineer for Sylvania Electric Products Inc., Chicago office, discussed lighting equipment and accessories, with particular emphasis on maintenance features, and influence on lighting maintenance upkeep and economy. Benjamin Duhov, Regional Engineer for Westinghouse Lamp Division, St. Louis office, discussed light sources of all types, with special emphasis on lamp life, indoor and outdoor use, effect of temperature and similar factors.

Other speakers discussed problems of interest to the NALMCO members from the standpoint of management and operation of their businesses, and from the standpoint of association operation and growth.

Personnel and Training was the subject of a talk by Kenneth Murphy, personnel manager of Spencer Chemical Company's Polyethylene Works, Orange, Texas. He predicted that over the next ten years (1) competition for personnel will increase greatly, (2) automation will increase by leaps and bounds, (3) there will be an increasing shortage of skilled labor, and (4) there will also be a shortage of management skill, trained to cope with the growing personnel problem.

Mr. Murphy defined the three primary functions of the personnel department as (1) to select people who can do the job, (2) to train these people, with their latent ability, to do the job, and (3) to create a climate in which these employees can grow. In discussing in detail the problem of training people, Mr. Murphy outlined ten separate things which management should do to insure the maximum effectiveness of their training program.

Marketing Research was discussed by Jack H. Perkins, economist with Midwest Research Institute. Mr. Perkins first reviewed the history of marketing research, over the past one hundred years, covering raw materials from mines and farms to factories, to distributors, to consumers. Included were such factors as design of products (or services), packaging, color, etc., which may influence brand preference and acceptance. He then related these factors to NALMCO's product - lighting maintenance service-and discussed how marketing research can be used effectively in selling this service to the nublic.

Advertising and Promotion was presented by Joseph M. Cahill of the Potts-Woodbury, Inc. advertising agency. A 13-minute color movie was first shown, which presented in a concise manner the many factors which must be considered in the preparation of an advertising and promotion program. Mr. Cahill then discussed ways and means for the association to advertise and promote its services, both from the standpoint of its individual members, and of the association as a service group. Questions from members further developed discussion of various media for advertising, probable costs, results, etc.

About half of the time allotted to sessions was devoted to business of the association, and to reports of the various committees, covering such subjects as finances, new members, material testing, national accounts, syndicated purchases, sales and advertising, and election of new officers.

A highlight of the business ses-

sions was a report on sales and advertising by Jim Watson, Fluorescent Maintenance Company. Denver, in which he reviewed results of a wide variety of direct mail letters and literature. Included in this report was such pertinent information as percentage returns, number of jobs sold as a result of each mailing, dollar volume of jobs sold, etc. These mailings included material prepared by association members as well as pamphlets, booklets, and mailing pieces prepared and supplied by the various lamp manufacturers.

New officers elected for the coming year, who took office as of May 1, are as follows: President-Glen Shatola, Lighting Service Co., Milwaukee, Wis; Secretary-Treasurer-Robert E. Watson, Fluorescent Maintenance Co., Denver, Colo; Regional Vice-Presidents— Eastern, Sam Feldman, Aetna Electric Co., Allston, Mass; Central, Edward I. Creed, C & S Lighting Maintenance Co., Cleveland, Ohio; Midwestern, Elmo Irwin, Lighting Services, Inc., St. Louis, Mo; Farwestern, Gerald Joseph, Lighting Maintenance Co., Albuquerque, N. M; and Southern, Malger H. Gray, Fluorescent Service Co., Tampa, Fla.

AHLI Names September as Home "Fixture" Month

This coming September has been designated "Home Lighting Fixture Month" by the American Home Lighting Institute, and is the third year that a month has been selected and so named. Object of this action is to "provide a single concentrated period in which all those who profit from lighting fixture sales can coordinate merchandising and education efforts for their mutual benefit," according to Robert W. Minett, Jr., president of AHLI, and director of advertising and merchandising for the John C. Virden Co. of Cleveland.

Despite fewer home starts during 1957, 15% more residential lighting "fixtures" dollar volume will be sold than during last year, based on industry surveys, Mr. Minett reports.

Plans for Home Lighting Fixture Month, which will embrace the entire industry, include: 1) merchandising kit for distributor members; 2) posters and streamers; sample letters for use in direct mail; campaigns to builders, con-



Satisfied USERS

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First and foremost, they're the SAFEST. Full protection against fire, shock or burn because all electric wires are completely sealed inside a finned aluminum casting. Only Electromode heaters have this Safety Grid heating element.

BASEBOARD Electric HEATERS

Designed for Modern Living



Spread a shield of comfortable warmth against cold walls, without drafts. Controlled by thermostat in each room. Matching baseboard fittings permit carrying out pleasing unbroken baseboard effect in any room.

Complete Line of ELECTROMODE HEATERS

Includes

WALL-TYPE and PORTABLE FAN-CIRCULATING HEATERS

RADIANT-CONVECTION

PANEL HEATERS

Wall Model For bathroom or BASEBOARD HEATERS
RADIANT CABLE HEAT

INDUSTRIAL UNIT HEATERS

- SUSPENSION-TYPE (Illustrated) 34,150 to 153,675 BTU
- PORTABLE and SUSPENSION 5,122 to 25,613 BTU
- EXPLOSION-PROOF HEATERS Fully tested and approved for use in areas covered in Class 1, Group D. 6830 to 20,490 BTU
- FARM HEATERS Milk House, broader pens, fruit and vegetable bins, etc. Pump House, valve pits, washrooms, warehouses.



Suspension-Type
Solves hard-to-heat areas in
the plant and isolated



Dept. EC-67, 45 Crouch St., Rochester 3, N. Y.
Please send FREE Electric Heating File, containing specifications, illustrations, installations, prices and how to figure electric space heating. We are interested in:

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☐ Home and Office Heaters ☐ Industrial Unit Heaters ☐ Farm Heaters

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You save hours



AN portable ELECTRIC

When you can't use motor-driven tools you lose profits fast. An Onan Electric Plant gives you plug-in electricity anyplace, anytime . . . no wait-ing for highline hookups . . . no long extension cords to get fouled up.

Onan 4-cycle electric plants feature split-second starting, long-life, and all-round dependability . . . with a big weight saving over usual 4-cycle units. The model 205AJ-IP pictured

above delivers 2,500 watts . . . enough for several saws, drills or other tools and all the lights you need . . weighs only 139 pounds. Model 105AK-1P delivers 1500 watts . . . weighs only 125 pounds.

Onan portable units are completely Onan-built with Onan engines directconnected to Onan all-climate generators. They are compact, sturdy...and they run longer with minimum servicing.

WRITE FOR FOLDER SHOWING PORTABLE MODELS

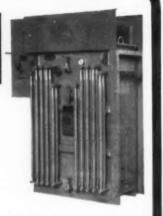
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Let Standard Transformer Company engineers help you meet load center problems. We'll work with you to design the transformers required to operate with existing switchgear or with new switchgear. Send us your plans or problems today and let us work out a practical, efficient, and economical solution with you. Write Standard or contact the nearby Standard Transformer Company Representative.



Type HT Askarel filled transformer 500 KVA, three phase, 2400x4800 volts primary, 4807/277 volts secondary Equipped with high voltage disconnect and transition ponels for filting with low voltage switch-



REPRESENTATIVES IN PRINCIPAL CITIES

tractors and architects: 3) a constantly widening national publicity program; 4) liaison with utilities, manufacturers, home builders, distributors, and lamp bulb manufacturers.

During September residential lighting equipment manufacturers will key their national advertising to support of the promotion. They will contribute to joint promotions of model homes where lighting fixtures will be featured, and will further cooperate with distributors to provide fixtures for display in model homes.

"Model Homes", according to Minett, "are the center of local promotions. Fixtures must be shown to be sold. More than 30,-000,000 people will visit model homes during National Home Week (Sept. 21-29). A tie-in between AHLI and the National Association of Home Builders will help guarantee well-lighted model homes in scores of communities.'

AHLI now has eight residential lighting equipment manufacturer members, and as a result of recently opening its ranks to distributors, it now has 45 distributor members.

Employees Stock Ownership Boosts Production and Profit For Electrical **Contracting Firm**

Broadening the base of employee stock ownership, thereby permitting production workers as well as officers and key personnel to become stockholders, has resulted in improved workmanship, production, sales and profits for the California Electric Works. This 37-year-old San Diego contracting firm with 200 employees (25% of whom own stock in the company) made this announcement after completing their best year (in dollar volume) since "Calewo" was founded in 1920. As explained by President Norman D. Ferguson, the policy operates under a unique buy-andsell agreement whereby stockholders have preemptive rights to any of the company's stock offered for

As early as 1924 the company decided that by permitting employees to have a share in the firm's ownership, pride of ownership and sharing of risks and profits would result in greater teamwork and in a greater sense of responsibility

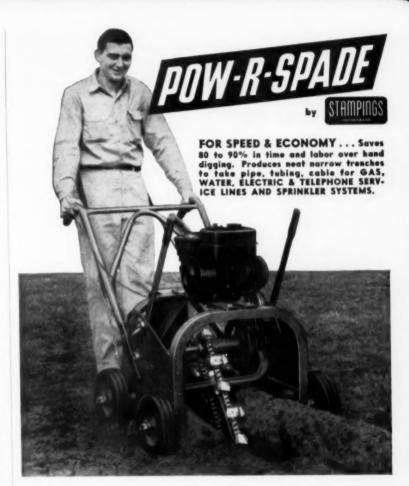
between fellow owner-employees. This has definitely been the case and, although profits were plowed back into expansion and improvement of the firm's facilities immediately following the war, dividends in recent years have risen rapidly, while the value of the stock has also increased steadily.

Employee-stockholders are briefed periodically on company sales, profits, policy matters and production techniques. Qualified repair men are also given the opportunity to earn overtime wages (and simultaneously promote the company's reputation for fast, round-the-clock service) by driving service trucks to their own homes at night in order to shorten the interval between an emergency call and getting a man on the job. Emergency calls are received by a night telephone dispatcher, who contacts the Calewo repair man living closest to the source of the call and, at any hour of the night, a service man usually arrives at the job-site in a matter of minutes.

This type of emergency service, in a county as large as San Diego (almost as large as the state of Connecticut), is a definite "plus" value in gaining and holding customers, who rely on this service for across-the-board work related to tract and custom home wiring. installation and maintenance of electrical and electronic controls, industrial lighting and distribution systems, plant electrical maintenance, marine electrical installations and repairs, motor rewinding and servicing, plus sales of appliances, motors and lighting fixtures.

G.E. Announces Full Motor Line to New MEMA Standards

Five years ago the National Electrical Manufacturers Association recommended new standards for the design of future ac induction motors, the objective being to provide industry with higher horsepower ratings for given motor frame sizes. This month, coincident with full production of a new line of motors in the 40- to 125-hp class, the General Electric Company becomes the first manufacturer to offer an entire line (from one to 125 hp) of such NEMA-standard induction drives. Intermediate steps to this now-complete redesign program were taken in 1953 and '54 when this same company introduced motors in smaller frame



POW-R-SPADE reduces man-hours to minutes!



Dirt is delivered finely pul-verized. Easy to backfill.

A POW-R-SPADE user reports that one man and the POW-R-SPADE digs a trench in 40 minutes which under same conditions required 2 men 8 hours with hand spades. POW-R-SPADE is field tested and enthusiastically approved by hundreds of users.

POW-R-SPADE digs a neat 3 in. wide trench to any depth from 1 in. to 24 in. Operated by one man from start to finish. This machine digs right up to foundation of buildings. No complicated set-up required. No ugly scars or wheel marks to mar lawns.

Powered by well known gas engine. Safe and economical. Rugged construction. Oil sealed bearings, minimum maintenance. Shipped assembled, ready to go to work. Mail coupon for details.





Portable from job to job-easily loaded and unloaded by one man.

	10171/2 Mound St., Devenport, la aterial on POW-R-SPADE to:
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COMPANY	
STREET	

Latrobe Electrical Products

There are no excess screws, wires or complicated parts in "Latrobe" Floor Boxes and Wiring Specialties. Their design and mechanism is simple, sure and compact.

That is why "Latrobe" Products are so quick and easy to install so efficient in service.



Two Gang Adjustable Floor Box

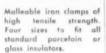
Adjustable Boxes come in single-round or square bodies. Also in square type Single Gang. Two Gang, Three Gang and Four Gang Boxes. All adjustable boxes are now banded which makes them fire-proof.

Non-Adjustable Floor Box

Represents the last word in unique design, neat appearance, fewest number of parts, and least amount of labor to install



Insulator Supports



Sold Only Thru Wholesalers

Latrobe Products

Non-Adjustable Floor Boxes Adjustable Floor Boxes Gang Boxes . . . Cover Plates **Junction Boxes** . Nozzles Pipe or Conduit Hangers Insulator Supports . Fish Wire Cable Supports . Staple and Cable Clips

Write for new catalog

Sales Representatives in all principal cities,

Fullman Manufacturing Co. 1209-1215 JEFFERSON STREET LATROBE: PA.

sizes to serve 1-to-5 and 7½-to-30-hp requirements.

Basing design upon comprehensive customer-preference studies, investigation of prevalent application and coordination of technological improvements, the manufacturers have achieved better heat-transfer systems by making motors more efficient, redesigning air passages, installing jet cooling for totally enclosed units, including new orifice features and heat-dissipating enclosure fins. Other improvements are obtained by using lower-loss steel, improved electromagnetic proportions, gasketed cast iron bearing and grease housings, new synthesized greases, tighter shaft fittings, polyester film insulations and Permafil glass wedges to lock stator windings in place. Balancing pins have also been redesigned to improve smooth, vibrationless operation, while rotor fans have been improved and repositioned to obtain optimum air movement at reduced noise levels.

In general, industry has wholeheartedly accepted transition to the new NEMA standards as they have become available, and manufacturers are realizing important savings in transportation costs due to the lighter weights and smaller dimen-

NISA News

The NISA membership report for the association's fiscal year ending March 31 showed another annual gain in active and associate members. The grand total was 1,566 as compared to 1,491 as of April 1, 1956, the beginning of the fiscal year.

The total includes 1,484 active or shop members, 76 associate or supplier members and six "privileged" members-retired individuals who have wished to continue their associations with friends in the industry.

Plans are under way for the Beaumont, Texas, meeting of the Southwestern Chapter of NISA, to be held on September 19-21 at Hotel Beaumont. George T. Kinard is general chairman; George O. Brandt is publicity chairman; Ray Welborn Jr., program chairman; Wardell Walker, transportation chairman; and Clark M. Phippen, entertainment and hotel reservations.

Quaker City Chapter held a chap-



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Easy, simple, fast! Minimum loading and unreeling effort. Modernly efficient

FOR WIRE, CABLE, ROPE

- Heavy gauge steel frame
- Slanted front
- Ball bearing adjustable rollers
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- Handles any reel diameters
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Style A 2,000 lbs. cap. Style B 4,000 lbs. cap. for reels up to 28 in. for 2 reels up to 24 wide Cincinnati.

46.50 f. o. b. in. wide each or I reel to 48 in. wide. 84.50 f.o.b. Cincinnati.

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ter meeting in Buffalo during the annual convention. The group and wives met for dinner before the convention opened Sunday night, May 12.

Chicago's NISA Chapter, called the Electric Motor & Service Association or Central District Chapter of NISA, met April 9 at Hotel Graymere. Five members discussed in detail the methods used in routing jobs through their shops. At the chapter's May meeting a program on resistors and applications was presented.

James Spaulding was elected president of Great Lakes Chapter; William Saunders, vice-president; Charles Howard, treasurer; Charles E. Smith, secretary; and Charles Johnson executive secretary. Pat Moran and Harry Kerr were named to the board of directors.

. . . . A. S. Tracy of Concord, New Hampshire, was elected president of New England Chapter; Frank Sweeney of Worcester, Mass.; vice-president; Robert L. Sandman of Boston, Mass.; secretary; and Brent Smith, Lowell, Mass., treas-

Members of the board of directors of the New England Chapter include the officers plus Bernard M. Rosenberg of Boston; Robert Bedig, South Boston; Hector Munro, Pawtucket, R. I.

New England Chapter meets on the second Thursday of each month at Hotel Bradford in Boston, It has been erroneously reported as the second or third Thursday in some quarters.

The shop of McNaughton-McKay Electric Co. in Detroit, was the site of the April 15 meeting of Great Lakes Chapter. E. H. Olson, assistant technical director of Anaconda Wire & Cable Co., Muskegon, Michigan, spoke on the topic "Magnet Wire, Present and Fu-

Ontario Chapter met on March 23 at The Walper House in Kitchener, Ont. Speaker was Don Hamilton of Dow Corning, who reviewed progress in silicone.

New York Metropolitan Chapter met April 18 at Gondolier Restaurant to see member John Ryan present a gold plaque to Meyer Friedkin for his contributions to the chapter. Mr. Friedkin, who has been ill, was unable to be present. so arrangements were made for a second presentation.

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Not Minutes



Not Hours

The quick, sure and easy way to drill concrete, asphalt, marble, granite, brick and tile; including reinforcing bars, pipe, conduit, steel, etc. that

might be encountered in the drilling.

Using Diamond Bits the Model "E" drills holes vertically, horizontally, or at any angle, from 1" to 9" in diameter up to 19 inches deep. Penetration speed averages about 1" to 3" per minute. Easily adjustable for drilling in tight corners. Light and portable

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CIRCLESHEATH® Type **RR** cable

1, 2, or 3 Conductor from 600 up to 15,000 volts for grounded and ungrounded systems Size 14 to 2,000,000 C.M.

CIRCOZONE - a butyl base ozone-resistant rubber compound designed for high voltage applications up to 15,000 volts on ungrounded systems.

Multi-conductor cables have individually insulated conductors twisted together with jute fillers, a tape cover and a neoprene sheath overall.

CIRPRENE - a tough Neoprene compound jacket with high resistance to abrasion, oils, acids, alkalies and heat, Specifically designed for direct burial in earth.

NEW WIRING CALCULATOR - FREE! Send today for this handy, useful wiring aid. Gives conduit sizes, amperage capacities, and helpful





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"WHAT'S THE BEST OUTDOOR

... Or post lantern. Or garage door light. Not earth-shaking questions, but they're the kind of specifics an electrical contractor deals with in an average day's work. Quick and sure practical answers can help him get business . . . help him make money at it.

More than likely he'll ask the counter man at his electrical distributor's, and get prompt help. The distributor's counter handles sales transactions, of course — but often much more.

Call it an *idea exchange*. Your electrical distributor knows the products that are moving, and he gathers new slants on applications from other electrical men. He's glad to pass them along because that's part of his job.

It's his business . . .

To stock the latest, most efficient products. To be able to explain their uses. To suggest alternate, money-saving applications. To give you service in a hurry.

These are a few of the reasons it pays to do business with your electrical distributor.

Wholesaling

A McGRAW-HILL PUBLICATION

The national magazine of electrical wholesale distribution





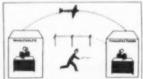
Your electrical distributor offers you these services:

His hundreds of purchase orders keep a flow of thousands of different products rolling from manufacturers into his warehouse the year around. By airmail, telegraph, telephone, the distributor keeps in touch with the many manufacturers whose lines he stocks, to expedite his shipments to you.

Regardless of how the distant manufacturer ultimately will compensate him, the distributor adjusts claims, returns goods, issues credits.

He trains and maintains a staff of salesmen who know the products required by the industry — where, how and when they are used.









PLUG RECEPTACLE?"



He assembles into single shipments the products of factories near and far, in sizes, types, and quantities the user needs. He maintains a warehouse from which you receive swift, economical delivery of a vast variety of products, plus staggered storing for specific jobs, as needed.

His counter and telephone service require trained men who know the hundreds of products handled, their uses, codes and ruling in effect locally.









Fantastic Idea Isn't It?

Keeping track of fast moving electrical materials prices without tools is as fantastic as bending conduit with your teeth.



The best tool for pricing is — NATIONAL PRICE SERVICE

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City	Zone State	10

WHAT'S THE LAW?

By Jack and Michael Strauss

QUESTION: May an electrical contractor look a gift horse in the face?

Harry, an electrical sub-contractor, became embroiled in a dispute with a heating sub-contractor over which of the two was required to provide certain items of electrical equipment on a job. Like two mules sitting in the middle of a highway, both refused to budge and neither supplied the parts. The result? Instead of stopping traffic, they held up the completion of the work.

Irate, the prime contractor finally stepped into the picture and decided that it was the heating sub-contractor's burden to supply the equipment.

What's more," he warned, "unless you obtain the parts in a hurry, I'll hold up your payments."

Without further ado, the heating sub-contractor purchased the equipment. In doing so, however, he insisted that there be a clarification of the specifications with regard to the disputed items.

Lo and behold, when the specifications were interpreted, it developed that it had actually been Harry's responsibility to supply the parts. Losing no time, the heating sub-contractor sued Harry for the money he had expended.

"I didn't ask him to buy the parts," the electrical sub-contractor told the judge. "If he wasn't required to do it . . . he should not have done it. Besides," concluded Harry, "he's already been paid for the equipment. He estimated the cost in arriving at the bid he submitted."

THIS WAS THE DECISION: Harry, the electrical sub-contractor, had to pay. The Court ruled that it made no difference what estimates were prepared by the sub-contractors as they were bound by their contracts as to who was to supply what.

Further, the court added, there was an implied contract between Harry and the heating sub-contractor that if it developed that Harry was required to supply the parts, he would repay the cost. Certainly, he could not sit back and accept the parts as a gift.

(Based upon a 1956 California Decision. State laws vary. For personal guidance, see your local attorney.) Homes, Schools, Factories

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CQ Fan, one of many models from 1400 to 154,000 C.F.M.





May be installed in any position

Whenever the call's for cooling, install COOLAIR. Costs you less —performs better—anywhere. For information and prices, write



American Coolair Corp.

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Two New Minerallac Quality Products
Designed for Jobs Too Heavy for
Standard Jiffy Clips

Heavy Duty AND Medium JIFFY CLIPS



Made of heavier materials! Mas exclusive inverted rib, that provides more strength at the bend of clip . . . and, of course, adds the benefits of famous "Snap On" feature!

In stock in Zinc-Plated Steel for Thin Wall or Rigid Conduit up to 6". (Hot Dipped Galvanized may be obtained on order) Can be substituted for malleable clips.

Order From Your Electrical Wholesaler
SEND FOR LITERATURE
MINERALLAC ELECTRIC COMPANY
25 North Peoria St. Chicago 7, III.

MINERALLAC



LOUIS DAEHNKE, chief armature winder in the shop of Moster Electric Motor Repair, Paramus, N. J., is shown here winding stator coils for some single-phase jobs.

DATES AHEAD

Illuminating Engineering Society — Regional Conferences: Northeastern Hotel Statler, New York, N. Y., June 12-13

New York State Association of Electrical Contractors and Dealers, Inc. -Annual convention, Saranac Inn, Saranac Inn, N. Y., June 30-July 7.

Illuminating Engineering Society
51st Annual National Technical Conference, Biltmore Hotel, Atlanta, Ga., Sept. 9-13.

Technical Conference on Electrical
Maintenance King Edward Hotel, Toronto, Ont., Canada, September

International Association of Electrical Leagues-Annual meeting, Sheraton-Gibson Hotel, Cincinnati, Ohio, Octohor 2.5

Electrical Progress Show — Commercial Museum, Philadelphia, Pa., October

Rocky Mountain Electrical League Annual convention, Broadmoor Hotel, Colorado Springs, Colo., October

Florida Association of Electrical Contractors — Annual Convention and Electrical Trade Show, Soreno Hotel, St. Petersburg, Fla., October 16.19

National Electrical Manufacturers Assn. - Annual convention, Traymore Hotel, Atlantic City, N. J., November 11-15.

National Electrical Contractors Association-Convention and Exposition, Netherland Plaza and Sheraton Plaza Hotels, Cincinnati, Ohio, November 11-16.



SAVE Time, Labor and Money

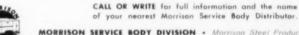


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for extra protection against rust and corresion.

- · Speed service calls take your workshop to the job.
- Tools and parts are safe from weather and theft—easy to load, easy to find, easy to inventory,
- For any make \(\frac{1}{2} \frac{34}{4} 1 1\frac{1}{2}\)-ton chassis—easy to mount or transfer.
- Complete line of Service Accessories engineered to your specific needs.



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needs only the VOICE for POWER!

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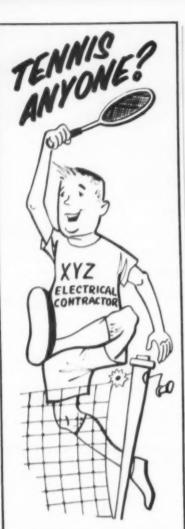
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GENERAL 36 ELECTRIC

Among the Manufacturers

Headquarters Announcements

H. K. Porter Co., Inc., announces the acquisition of R. Thomas & Sons Co., Inc., of Lisbon, Ohio, to be combined with the Delta-Star Electric Division.

Elliott Co., Jeannette, Pa., has merged into Carrier Corp., Syra-

cuse, N. Y.

Rome Cable Corp., Rome, N. Y., has purchased plant, equipment and other assets of T. J. Cope, Inc., Collegeville, Pa.

Westinghouse Electric Corp., Pittsburgh, Pa.—John H. Chiles, Jr., and B. M. Brown, new vice presidents.

Crouse-Hinds Co., Syracuse, N. Y.

A. D. R. Fraser, new director.

Minnesota Mining & Manufacturing Co., St. Paul, Minn.—Joseph C. Duke and Bert S. Cross, elected to board of directors, in addition to duties as vice presidents.

Preformed Line Products Co., Cleveland, Ohio—R. F. Hollitz and F. L. Irvin, new assistant general managers of sales.

Westinghouse Electric Corp., Pittsburgh, Pa.—James H. Jewell, vice president in charge of market-

ing.

National Electric Products Corp., Pittsburgh, Pa.—Carl P. Cronk, director of marketing research; John L. Auch, treasurer and director; Vincent P. Oatis, Jr., distributor sales manager; Albert J. Borelli, personnel manager of Sales Division.

Thor Power Tool Co., Chicago, III.—James A. Lind, vice president, finance; John F. Corkery, vice president, public relations.

Robertshaw-Fulton Controls Co., Acro Div., Columbus, Ohio—William Ohly, manager of distributor sales.

Anderson Electric Corp., Birmingham, Ala.—C. E. Bitzer, vice president in charge of sales.

Paranite Wire and Cable Div., Essex Wire Corp., Ft. Wayne, Ind. O. W. Andersen, sales manager.

United States Steel's Columbia-Geneva Div., San Francisco, Calif. George W. Searles, manager, wire rope and electrical wire sales.

Anaconda Wire & Cable Co., New York—H. Donn Keresey, chairman of the board; William E. Sprackling, president and chief executive officer; Richard B. Steinmetz, executive vice president; David E.

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Allen, vice president—sales; Vito F. di Lustro, vice president—manufacturing.

Iron Fireman Mfg. Co., Cleveland, Ohio—Lewis J. Cox, first vice president and chief executive officer.

Line Material Industries, Mc-Graw-Edison Co., Milwaukee, Wis.—James G. Everhart, vice president and general manager, Illinois Edison Porcelain Div.; Walter Matzelevich, plant manager, fibre products plant, Sherman, Tex.

Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.—Richard DeStefano to direct nationwide sales of proximity switches.

A. L. Smith Iron Co., Chelsea, Mass.—Louis E. Newman, president; Julian J. Smith, chairman of board of directors and treasurer.

General Electric Co., Schenectady, N. Y.—Dr. F. Meade Bailey, manager of advanced engineering; Joseph S. Quill, manager of marketing research and product planning, both with Industry Control Dept., Roanoke, Va.

Hubbard and Co., Pittsburgh, Pa.—Clarence H. LeVee, director of engineering, research and devel-

opment.

R T & E Corp., Waukesha, Wis.— Loren D. Barre, assistant to the vice president.

Federal Pacific Electric Co., Newark, N. J.—Marvin C. Bonine, manager, Pacific Switchgear Division.

Century Lighting, Inc., New York—Henry Kogel, sales engineer for television lighting.

General Electric Co.'s Industrial Heating Dept., Shelbyville, Ind.— Clarence M. Stevens, manager of manufacturing.

Arrow-Hart & Hegeman Electric Co., Hartford, Conn.—P. J. Sullivan, president; J. R. Cook, chairman of the board; Rollin N. Peck, secretary.

Curtis Lighting, Inc., Chicago, Ill.—Harold S. McCullagh, treasurer.

Carrier Corp., Unitary Equipment Div., Syracuse, N. Y.—George T. Long, director of marketing; William A. Lake, sales manager.

Tomic Sales & Engineering Co., Detroit, Mich.—Russell M. Smith, vice president in charge of sales.

H. K. Porter Co., Inc., New York
—Arthur S. Nippes, vice president
and general manager, Henry Disston Div.

Kurz & Root Co., Appleton, Wis.
—Eli Chappe, vice president in charge of commercial sales.

Allis-Chalmers Mfg. Co., Milwaukee, Wis.-J. S. Morgan, di-



• R & S Ever-Lok complete lines from Midget type 10 amperes to 200 amperes heavy service types . , standard or reverse service . , fused and non-fused types.

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Goehler & Adams Milwaukee, Wisconsin

John J. Goekler Appleton, Wisconsin

Hopper & McCoy Atlanta, Georgia

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Peter Jacobson Jenkintown, Pennsylvania

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rector of domestic sales, Allis-Chalmers Industries Group.

Federal Sign and Signal Corp., Chicago, Ill.-Don F. Feerer, vice president.

Regional Appointments MIDDLE ATLANTIC

Preformed Line Products Co.: E. H. Brown, district manager of sales, eastern area.

General Electric Co.'s Large Lamp Dept.: Everett G. Agee. sales manager, eastern region, office in New York.

R T & E Corp.: John Conwell, representative in New York, New Jersey and Pennsylvania.

Fielden Instrument Div., Robertshaw-Fulton Controls Co.: Nickles Engineering Co., Rochester, N. Y., representatives for New York State area

Miller Co.: Ernest Voos, sales representative for Illuminating Div. in Philadelphia-Wilmington

Allis-Chalmers Industries Group: Thomas W. Metz, manager of Mid-Atlantic region.

Clark Controller Co.: William S. Stamp, district manager of Buffalo

SOUTH ATLANTIC

General Electric Co.'s Large Lamp Dept.: Douglas B. Clark, sales manager of Southern Region. office in Atlanta, Ga.

R T & E Corp.: Howard A. Dunn. sales representative in Washington area.

Moe Light Div., Thomas Industries, Inc.: Jerry P'Pool, sales representative in North and South Carolina, office in Charlotte.

Rockbestos Products Luther M. Rudisill, Jr., district sales manager for Southeast territory, office in Atlanta, Ga.

Miller Co., Illuminating Div.: Donald W. Goodwin, sales representative in Washington, D. C. area: Olin R. Wood, sales representative for North Florida and South Georgia.

Fulton Sylphon Div., Robertshaw-Fulton Controls Co.: James D. Crum, sales engineer, Baltimore

Federal Pacific Electric Co.: Gordon E. Granger, Jr., manager of Virginia branch.

EAST CENTRAL

Moe Light Div., Thomas Industries Inc.: Albert N. Bloom, sales representative for central Illinois, office in Peoria.

General Electric Co.'s Large Lamp Dept.: Frederick F. Denny,

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sales manager, Midwestern Region, office in Chicago: Joseph M. Lime, East Central Region, office in Cleveland

Preformed Line Products Co.: R. A. Bell, district manager of sales. Cleveland.

Baldor Electric Co.: Clarence W. Flaig, representative for Motor Div. for Louisiana, Mississippi, Alabama, and parts of Florida and Tennessee: Edwin H. Gahn, sales engineer for Northern Indiana and Northern Illinois, plus Chicago.

Westinghouse Electric Corp.: Donald M. Canfield, assistant sales manager for Lamp Division in central region.

BullDog Electric Products Co.: Edward F. Maisel, field engineer in new office in Ft. Wayne, Ind.

Gould-National Batteries, Inc., Industrial Div.: S. V. Malin, district manager in Detroit, Mich.

Miller Co., Illuminating Div.: James G. Terry, sales representa-tive in Alabama; Thomas J. Evans, sales representative in Northern Illinois, Eastern Iowa, Northeastern Missouri and Southwestern Wisconsin: Donald R. Potter, sales representative in Northeast Ohio.

WEST CENTRAL

Wolverine Tube, Div. of Calumet & Hecla, Inc.: Del E. Wessels, technical sales representative in Oklahoma and North Texas areas.

Miller Co., Illuminating Div.: J. Gordon McDonald, sales representative in Kansas, Western Missouri, and Oklahoma.

Markel Electric Products, Inc. and LaSalle Products, Inc.: William A. Foley, representative in Kansas and Western Missouri.

Century Electric Co.: Donald R. Vick, in charge of new branch office in Portland, Ore.

Universal Mfg. Corp.: George J. Kaufman, regional manager of new West Coast Regional Branch in Los Angeles.

Allis-Chalmers Industries Group: W. M. O'Conner, manager of Amarillo district. Texas.

Rockbestos Products Warren S. Jones, district sales manager, Louisiana, Texas and New Mexico.

General Electric Co.'s Large Lamp Dept.: Donald D. Scarff, sales manager for Western Region, office in San Francisco, Calif.

Preformed Line Products Co.: J. W. Ramey, manager of operations, Palo Alto, Calif., plant; D. B. Evans, district manager of sales, West Coast.

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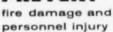
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These manufacturers advertised their products in the ELECTRICAL PRODUCTS GUIDE

For more complete information, and application data on their lines, refer to the index of Advertisers in the ELECTRICAL PRODUCTS GUIDE . . . the 13th issue of ELECTRICAL CONSTRUCTION AND MAINTENANCE.

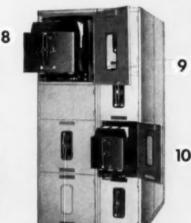
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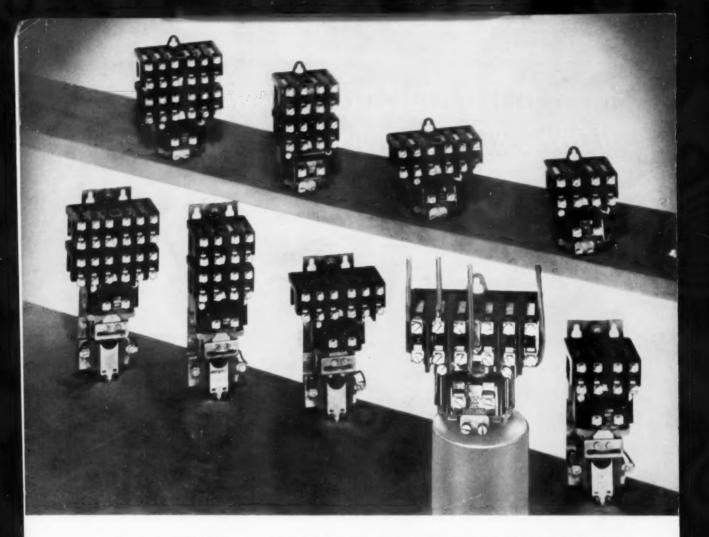
- New design Type LA circuit breakers with T type handle for easier manual operation
- 2 Hinged doors provide ready access to circuit breakers
- 3 Fully equipped compartment for future breaker
- Four 225 ampere LA-15 or 600 ampere
 LA-25 circuit breakers can be mounted in
 an 18" wide vertical section
- Three 1600 ampere LA-50 circuit breakers can be mounted in one 26" wide vertical section. Wider sections are available for higher capacity breakers—34" for 3000 ampere and 40" for 4000 ampere
- Enclosure is 91-%" high and 54" deep. Durable, baked enamel blue-gray finish over rust-inhibiting primer
- Instruments and meters on hinged door of isolated compartment
- 8 Circuit breakers are mounted on positive pantograph drawout mechanism which holds breaker in connected, test, disconnected, or fully projected position
- Bussing is silver plated and braced for 50,000 ampere minimum. Arranged to provide adequate space for cables
- Pantograph drawout mechanism projects breaker beyond front of switchgear—permits easy inspection of disconnect contacts without breaker removal. When desired, breaker can easily be lifted from pantograph mechanism



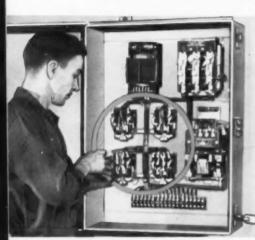


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Easy installation with General Electric machine tool relays means time saved. Three keyhole slots simplify mounting. In addition, the captive saddle-clamp terminals can be wired from top, bottom, or either side, and are accessible from the front. Also, the new 6-pole-in-line and 12-pole forms have the same mounting dimensions as the 4- and 8-pole forms respectively.

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For quick delivery, see your General Electric Distributor. He can also give you complete information, or write for Bulletin GEC-1415 (standard forms) or GEC-1416 (latched-in forms) to Advertising Section 733-25, General Electric Company, Bloomington, Illinois.

GENERAL & ELECTRIC

